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THE AUTOMOBILE

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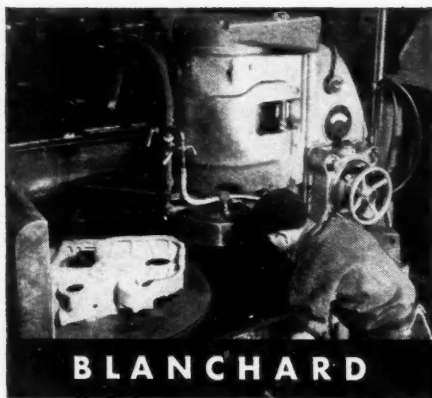


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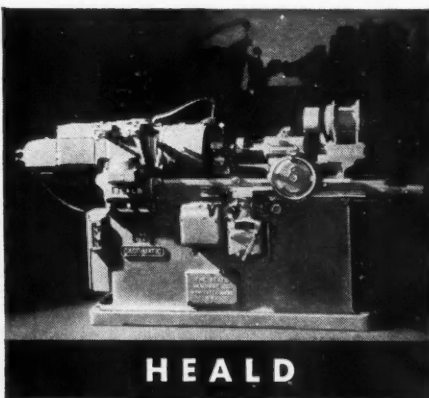
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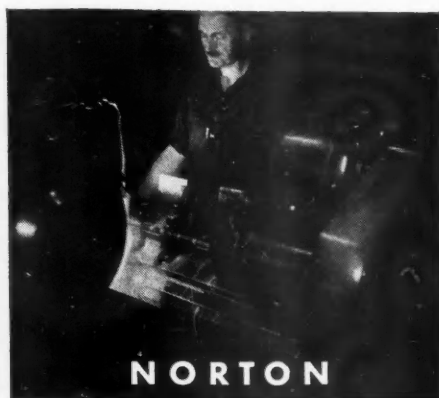
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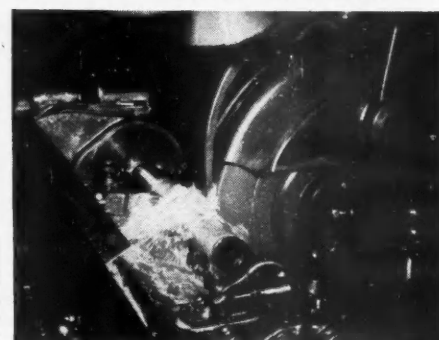
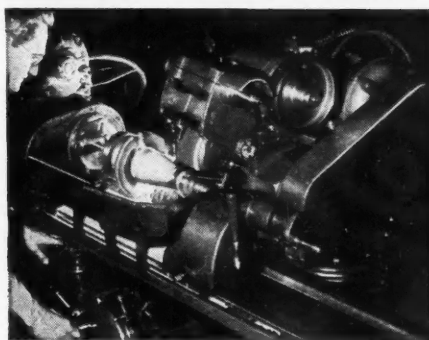


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AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

Volume 85 July 1, 1941 Number 1

Many Plastic Parts on '41 Automobiles

Some 110 plastic parts with a total of more than 225 possible applications are used on the composite 1941 automobile, according to a survey made by the plastics department of the Du Pont Co. In the 1942 automobiles this figure will be increased to 120 parts because of the scarcity of metals and also the inherent advantages of plastics. A tabulation of the plastic parts on the composite 1941 automobile follows:

Instrument Panel.

Dashboard: decorative overlay panel.

Glove Compartment: door strip, ornament.

Speedometer: lens, dial ring, panel, pointer, dial back, cable washers (2), odometer lens.

Radio: push buttons (8), control knobs (2), grille, grille ornament, lens, dial scale, panel.

Cigar Lighter: housing, base, washer, fuse washer, insulator bushing.

Knobs: throttle, choke, light, signal switch, windshield wiper, ventilator, heater, hood latch, lighter, gearshift, window regulator.

Clock: panel, dial ring, lens.

Steering Wheel.

Lock Switch Body.

Accelerator Pedal.

Escutcheons (12).

Door Bumper Shoes.

Door Locks (4).

Garnish Molding Medallions (5).

Shank Insert on Door Handle (12).

Dome Light: lens, switch, insulating block.

Upholstery: buttons (20), trim moldings (4).

Ash Tray: lid, knob, lamp bushings.

Interlayer for Safety Glass.

Headlights: sockets (2), washers (2), terminal plates (2), black insulators (2), terminal block, switch base.

Radiator Ornament.

Parking Light Lens (2).

Bonnet Sidelight Lens (2).

Antenna: insulator, bushing.

Rear Signal Light: lens, flasher, washer, contact support, sleeve switch.

Direction Indicators (2).

Trunk Light Lens.

Tail Light Lens.

License Plate Lamp Lens.

License Plate Lamp Name Plate.

Gasoline Tank: cap lens.

Gasoline Tank Gage Unit: washers (3), contact strip base.

Trucks, Trucks, Trucks for the Army

13

Did you know that the U. S. Army now has nearly ten times as many trucks in service as they did on the first of January, 1940? You will find something in this article that will really surprise you, unless you are more "in the know" than most folks.

Mass Production Unit at the Olds Plant for the Manufacture of Shells

14

Great changes have been wrought and much accomplished in turning over production from things automotive to things explosive. Joseph Geschelin made trip to look things over and learn just how these great things had been done. With his usual thoroughness he introduces one to the raw material and carries one right on through to the shipping.

Aircooled Motors' Production

Line Displays Adaptability

20

This organization, built on the pioneer work of the Franklin engine, is building a line of two fours, two sixes each with a wide variety of options as to equipment and cylinder sizes. To meet this wide variety of demands they have built up a system that sets an example for ability to meet the many changes necessary.

New Borg and Beck Fluid Clutch

34

Here is a new development that you must read about to keep in pace with the march of progress.

Chemically Coating Metals to Reduce Wear

37

Here is where the chemist again enters the picture and paints in a whole new complexion on lubrication. There are pictures that are enlightening, graphs that are instructive and tables that are just brimming with data.

Water Pump Part.

Spark Plug Caps (8).

Generator Base.

Distributor: housing, cap, rotor, cable caps (6), insulators (2), bushing, point friction pad, point terminal insulating pad.

Voltage Current Regulator: insulating sheets and tabs, ammeter terminal block.

Coil: tap, terminal, base, box, cover, resistor.

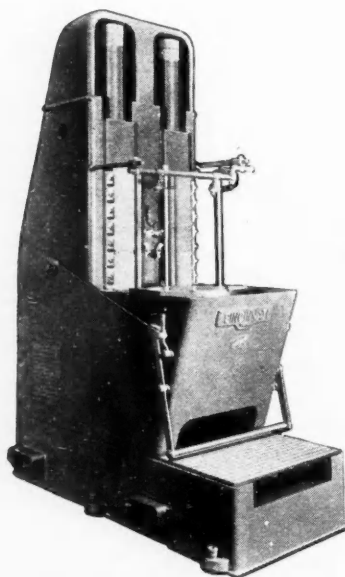
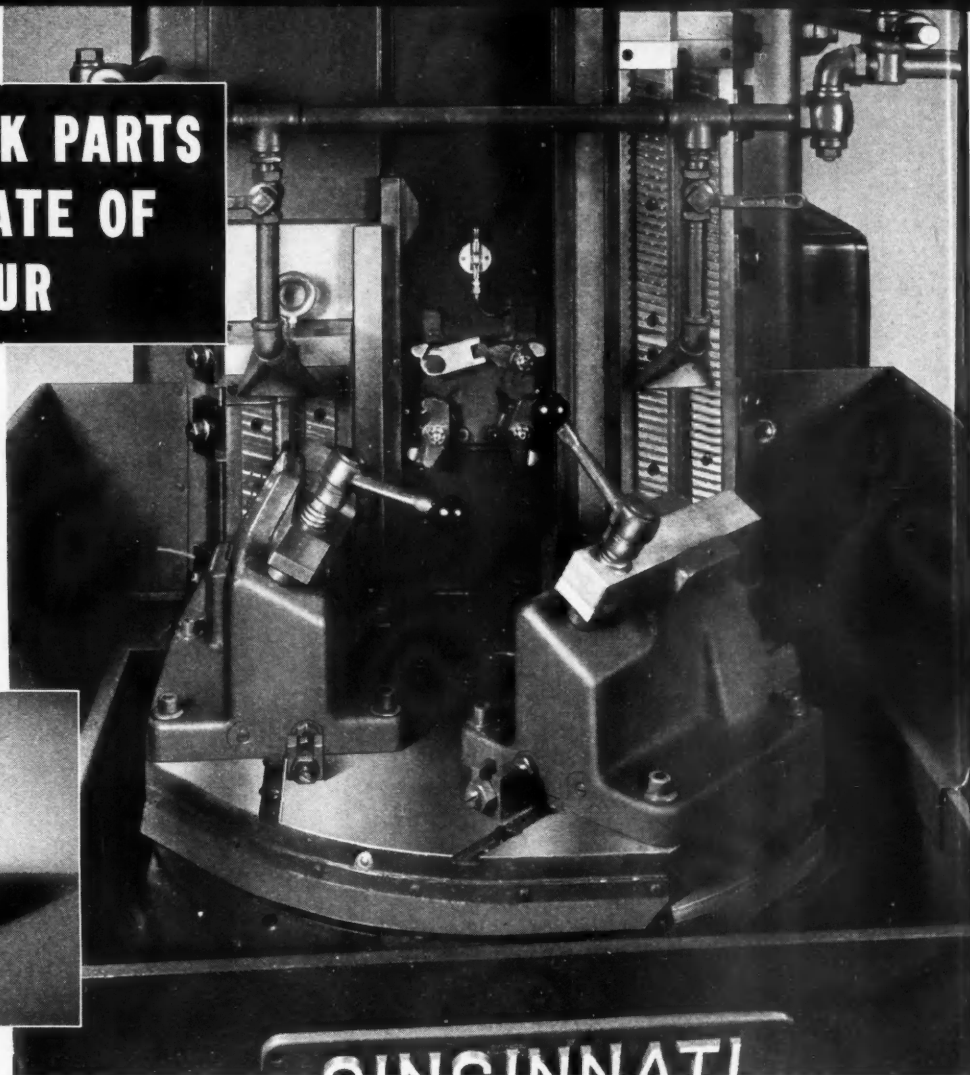
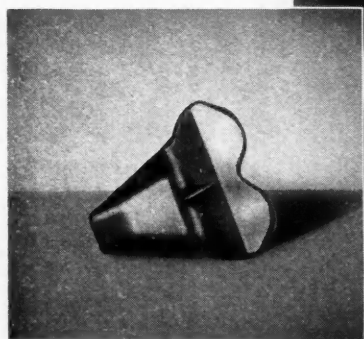
Horn: button, blowing ring, contact plate, insulator, washer, block insulating pads (2), relay horn insulating pads (2).

Wire Connectors (17).

Battery Box.

Transmission Washers (4).

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**CINCINNATI No. 5-42 Duplex
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The machine—a CINCINNATI No. 5-42 Duplex Vertical Hydro-Broach—broaches two stepped surfaces. Being a standard product, its other capabilities of smooth finish and accurate limits are available whenever needed. For the part illustrated, speed of production is the chief requirement, and speed at the rate of 450 parts per hour can be obtained.

There are several features of the CINCINNATI Hydro-Broach contributing to its rapid production characteristics. Practically continuous cutting with the exclusive swivel table arrangement—one ram, say the left hand, cuts on the down stroke, while the right hand ram returns to the top and the operator loads and unloads the right hand fixture. Dovetail and clamp arrangement for the broach holders speeds set-up time. Other features are illustrated and described in catalog No. M-894. Write for your copy today.



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Trucks, Trucks, Trucks, for the Army

MOTORIZED equipment for the U. S. Army is rolling off the assembly lines of the automobile industry at a current rate of approximately 25,000 motor trucks per month. These range all the way from the one-quarter ton combat cars, or "blitz buggies," which scramble over the roughest terrain with the agility of mountain goats, to the big six-ton 6x6 vehicles which are used to haul 3-inch guns about the country.

The Quartermaster Corps estimates its requirements at 250,000 motor vehicles, including 40,000 motorcycles, for an army of 1,400,000 men. But the whole program of expansion is so vast and so rapid that this may be revised upward in the next few months, especially if the size of the army is doubled, as some military leaders have advocated.

The Army now has approximately 170,000 motor vehicles in service, exclusive of motorcycles. This compares with 11,600 in 1937 and 19,000 on Jan. 1, 1940, before the fall of France made the national defense program imperative. From Jan. 1 to April 15, 1941,

21.6 per cent of U. S. truck production, or 61,817 vehicles, was for military purposes, according to a survey by the Motor Truck Committee of the AMA for the OPM. During the first World War, the government ordered 243,232 military vehicles, exclusive of motorcycles, of which 116,808 had been delivered by the end of the war and 62,247 were shipped overseas. The figures are from the report of the War Industries Board.

The figures of the Quartermaster Corps in the current Army expansion do not take into account the vehicles of the Armored Force, which are procured through the Ordnance Dept. There is an essential difference between an armored division and a motorized division. An armored division transports all its personnel in armed and armored vehicles, including tanks and scout cars, most of which are employed as weapons. A motorized division transports a part or all of its supplies, weapons and personnel to the battlefield in trucks. There the division dismounts and

(Turn to page 72, please)

International Photo



Mass Production

at the Olds Plant for the

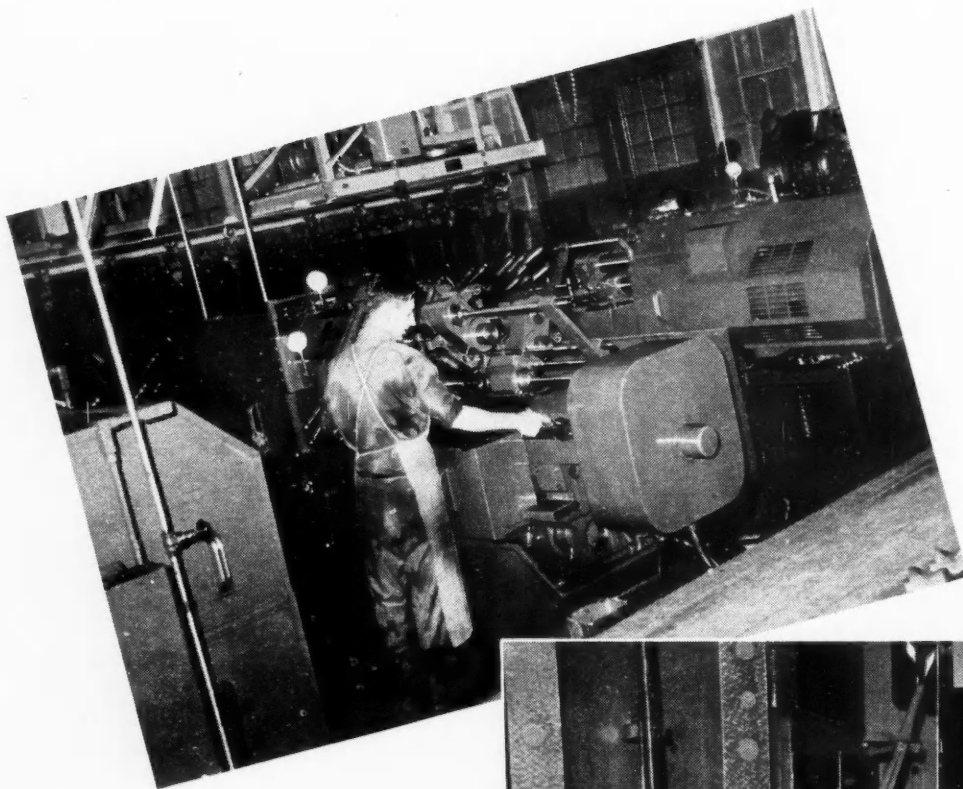
THE AUTOMOTIVE industry may be justly proud of the accomplishment of the Oldsmobile Division of General Motors Corp., in the development of a completely mechanized mass production unit for the manufacture of high explosive shells for the United States Government. Not only does the new plant exhibit the very essence of the mechanical skills of the industry, but the entire set-up exemplifies the close cooperation between industry and the military estab-

lishment, contributing largely to the introduction of techniques and processes quite unique in ordnance manufacture.

Scene of the operation is the newly acquired GM Forge Plant of the Oldsmobile Div., located on the outskirts of Lansing, Mich. The plant is tooled with the most modern specialized equipment known to the

art for the production of 75 mm. and 105 mm. high explosive (H.E.) shells. The 75 mm. lines are scheduled for an output of 600 per hour while the 105 mm. size will have a productivity of 250 per hour.

Apart from the many items of specialized equipment which set this operation apart from the conventional, the process incorporates a number of unusual features. First is the fact that it is based upon the upsetting of shell blanks from bar stock; second, the adoption of forging die design, per-



(Above) Battery of 8-spindle chucking machines on the 75mm line—rough-facing and finish-facing closed end, rough boring and finish-boring open end, threading, etc.

(Right) Close-up of one of the stations of the huge eight-spindle vertical lathe which handles the 105 mm shell in two indexing operations.



Unit

Manufacture of High Explosive

SHELLS

mitting of such close control of the piercing operations as to make it unnecessary to finish the cavity; and third, the introduction of cold nosing of the open end of the shell on heavy duty presses, eliminating the many problems introduced in the hot nosing procedure.

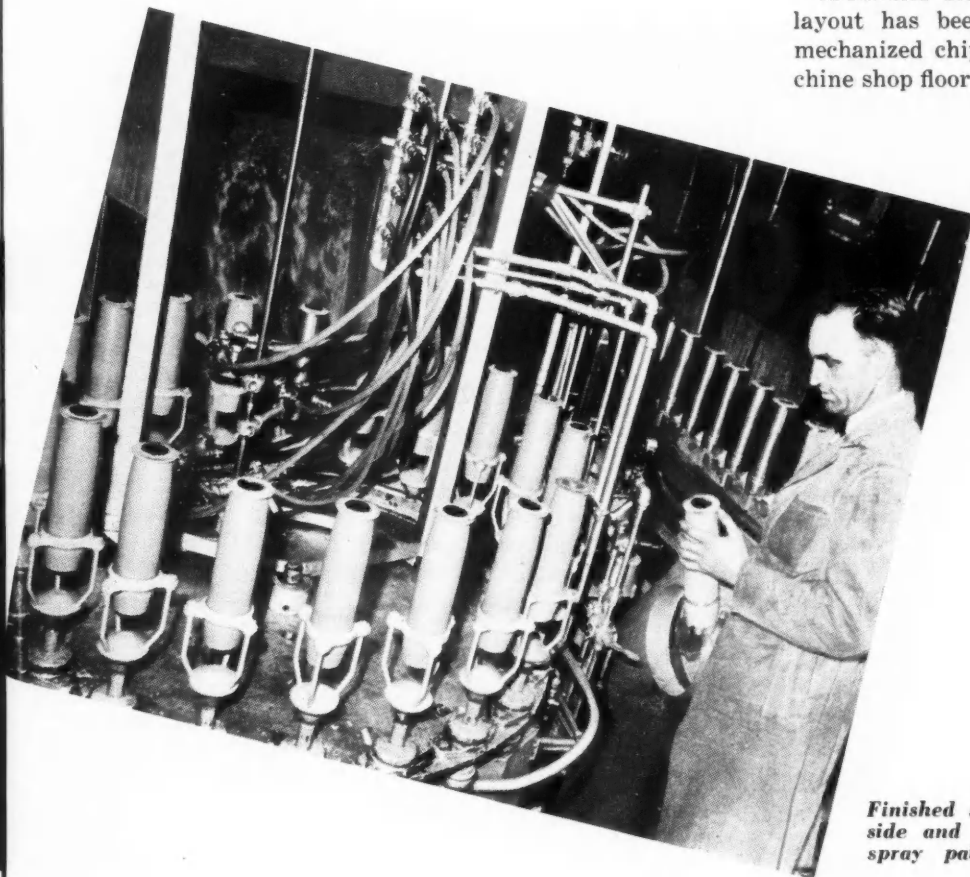
Although the precision forging process achieves great economy in the overall operations, and aids materially in effecting the high productivity, it involves many neat problems of forge shop management. For one thing, the intensive use of the forging machinery and punches and dies, coupled with the drastic effects of the high temperature at which the work is done, makes it necessary to replace the dies at frequent intervals. Consequently, one of the biggest departments in the plant is the well-equipped die shop which is kept going full speed ahead on the preparation of replacement punch and die sets. Even the finest die steels available for the purpose cannot withstand for long the severe punishment of intense heat and great pressures.

While on the subject of the die sets, it is of interest to comment upon one troublesome problem that was overcome in the early stages of this development. It was found that in the final piercing operation, there was a tendency at times for the gases trapped at the head of the shell to develop tremendous pressure, sufficient to destroy the wall at that end. This was solved by drilling a 1/16-in. hole completely through the length of the punch, this providing a vent for the release of these trapped gases.

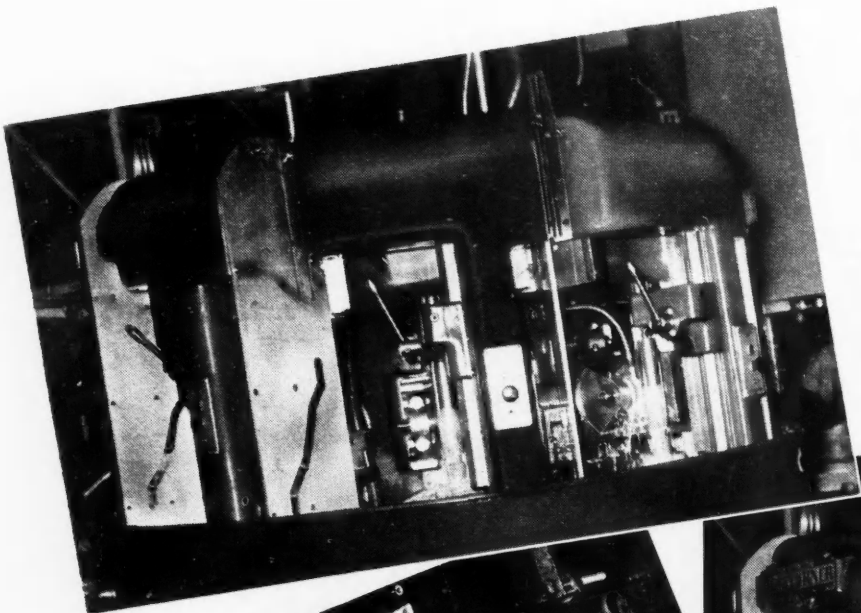
An outstanding feature of this plant, obvious to the observer, is the degree to which mechanization has been carried through the medium of overhead mono-rail conveyor lines of heavy duty design. The system of overhead conveyors linking the forging department and the machine shop lines has a developed length of some 7500 feet. In addition, there are gravity roller conveyor sections in various places, also a mechanized slat conveyor which carries the finished shells from the Government inspection benches to the packing and shipping station.

A further example of the skill with which the plant layout has been developed is the installation of a mechanized chip conveyor in a tunnel under the machine shop floor. This consists of two parallel conveyor lines communicating with the metal cutting machines on the 75 mm. and 105 mm. machine lines, these in turn unloading onto the chip disposal conveyor at right angles which carry the chips through a crusher, then elevated to gondola car.

Plant operation is divided into two distinct activities—the self-contained forge shop for preparing the shell blanks; and the machine shop departments. The forge shop has three separate upset units for the forging of 105 mm. shells; five upset units for the 75 mm. size. The machine shop area is divided into two separate and parallel departments — one mechanized



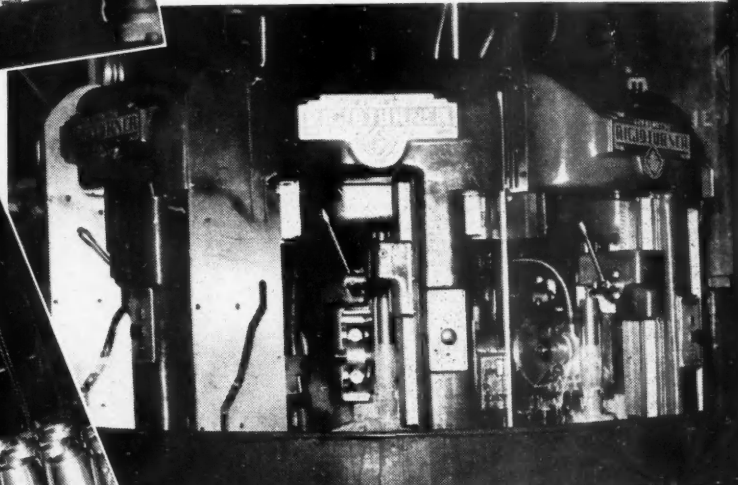
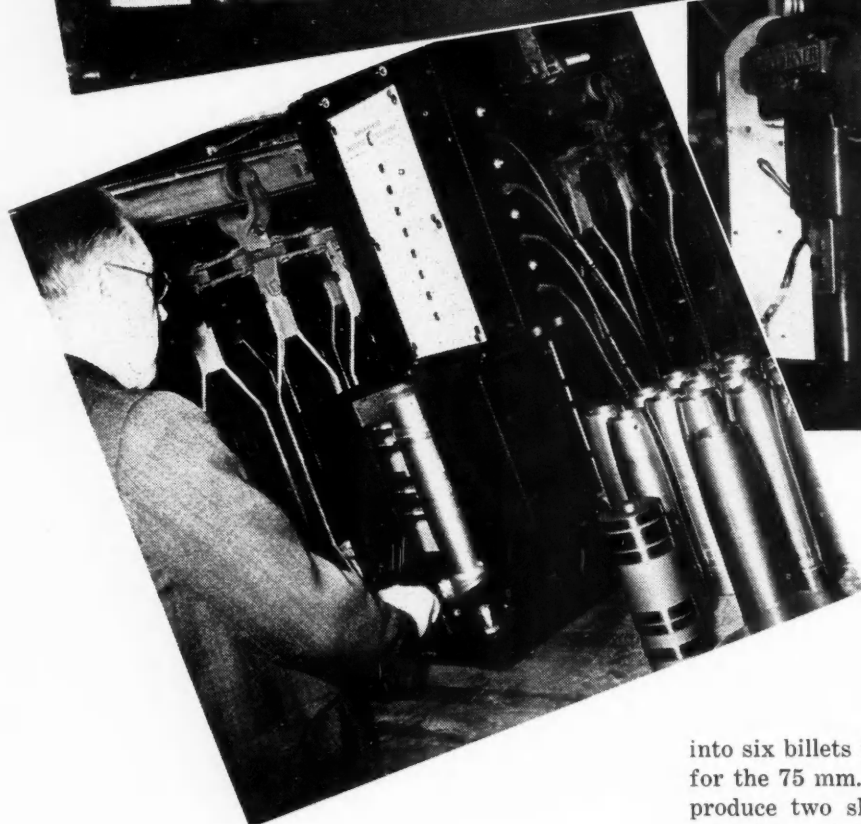
Finished shells are sprayed on the outside and inside, automatically, on this spray painting machine fitted with a rotary table.



(Lower left) Final inspection of shell contour on the new electric gage.

(Left) Rough turning and rough facing operations on the 75 mm shell are performed on this special eight-spindle vertical lathe.

(Below) Following rough turning, the open end of the shell is cold-nosed on a big press which may be seen in the background at the extreme right, then finish-turned on the OD and the closed end on this eight-spindle turning machine. The turning machine is an adaptation of the familiar automatic gear hobbing machine widely used in the industry.



shells is almost identical, the following discussion will cover the fabrication of the 75 mm. size, noting later the several differences in production equipment.

Bars 18 ft. long come in from storage on a conveyor and are preheated before being sheared into six billets for the 105 mm. shell, into eight billets for the 75 mm. size. Each billet has sufficient stock to produce two shells. This is followed by a sampling inspection of the stock, checking for seams, pipes, etc. For this purpose, both ends of each bar are polished, then the ends of the billets are immersed in a hydrochloric acid bath for etching. After rinsing, the bar is inspected.

From the etching tank, the billets are automatically loaded onto the monorail conveyor which transports them to the forge department and deposits them automatically in front of electric heaters. First operation here is to heat the billet, a little more than midway, in an induction heater which brings it up to a temperature of 2350 deg. Fahr. in about two and a half minutes. The billet is immediately transferred to a 4-in. upsetting machine. The 105 mm. shell is forged on one of the huge 6-in. upsetting machines.

The forging machines are fitted with six die stations—the first takes the upsetting operation, the others are stages of piercing and forming. The fifth station cuts off the upset end. While still hot, the

line for 75 mm. shells and a similar line for the 105 mm. size. All of the operations are linked completely by the monorail conveyor system.

Finally, before proceeding to the actual details of the process, we wish to emphasize that the very essence of the operation is that of precision controls and rigid attention to quality on the part of both GM Forge and Government inspectors.

Initial stage of the fabrication begins with the storage of round bar stock. Bars are segregated in separate piles, keeping together all material of a given heat from the steel mill. Such bars are suitably identified by the use of color marking on the ends. The heat number is carried as a part of the marking on every shell that leaves the plant.

Since the series of operations for both sizes of

forged blank goes to a trim press where the tong hold is sheared off. The shell is inspected here, then placed on monorail for air-cooling, while traveling to shot blast operation.

The blank cavity is shot blasted to clean out all

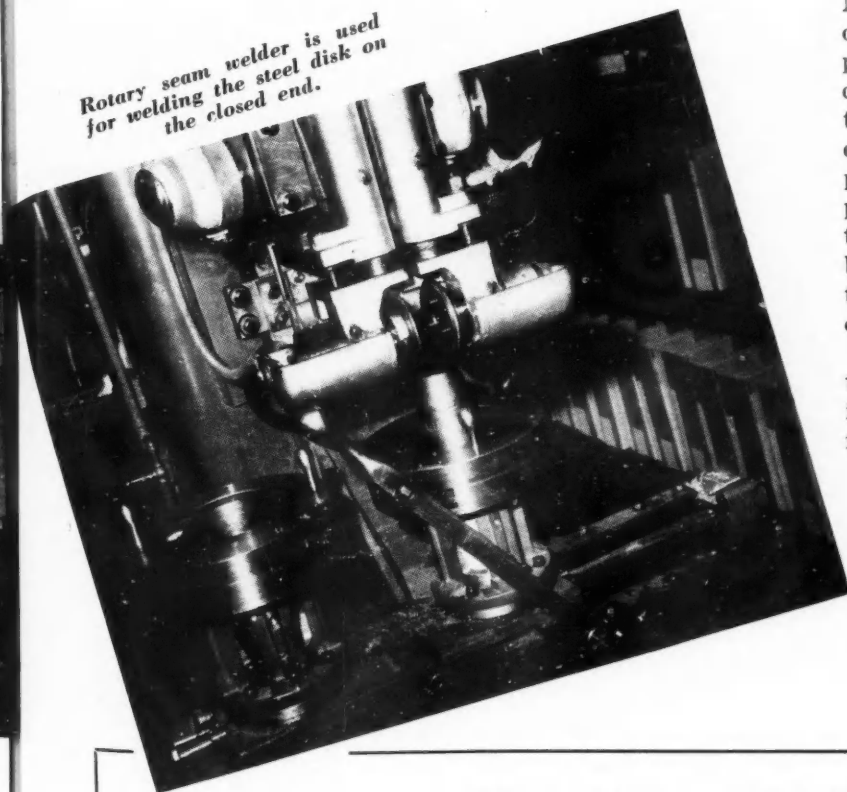
scale and the forging is given a five per cent inspection for Brinell hardness, then placed on monorail which carries them to the machine shop.

First metal cutting operation is that of centering the closed end on a special centering machine, locating the rough blank from the closely held cavity. Next is the rough-turning on one of a battery of special vertical lathes, made by a prominent producer of precision boring machines. This consists of rough turning the O.D., rough-cam turning the closed end, rough facing the open end, rough facing the closed end, turning center plug and chamfering the open end. To effect a positive control of the various automatic functions of this machine, each machine is served by a special controller unit, providing accurate timing for the action of the tool slide, and for operating the brake on the magnetic clutch.

Each operator inspects his own shells, then the blank moves on to the cold nosing operation in a huge press, producing a nicely finished surface ready for the final machining operations.

Finish-turning of the O.D. and finish-cam-turning of the closed end are done automatically in an unusual machine. This is an 8-spindle Rigidturner, essentially a special modification of the familiar gear hobber so widely used in the industry. The shell then moves on to a battery of two-spindle sensitive drills for drilling and tapping.

Rotary seam welder is used for welding the steel disk on the closed end.



Operations on 105MM Shells

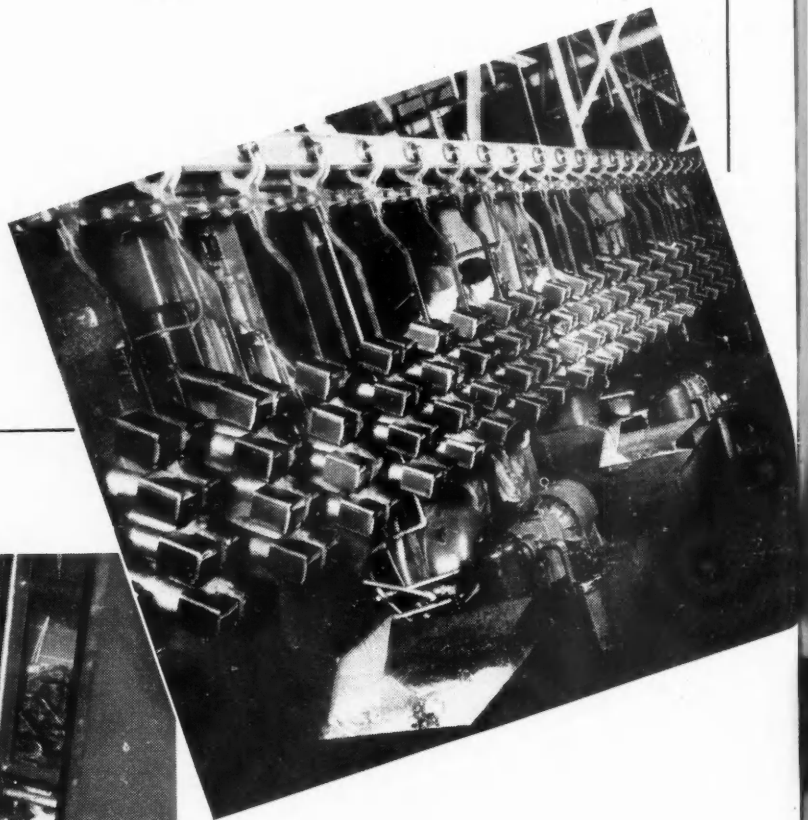
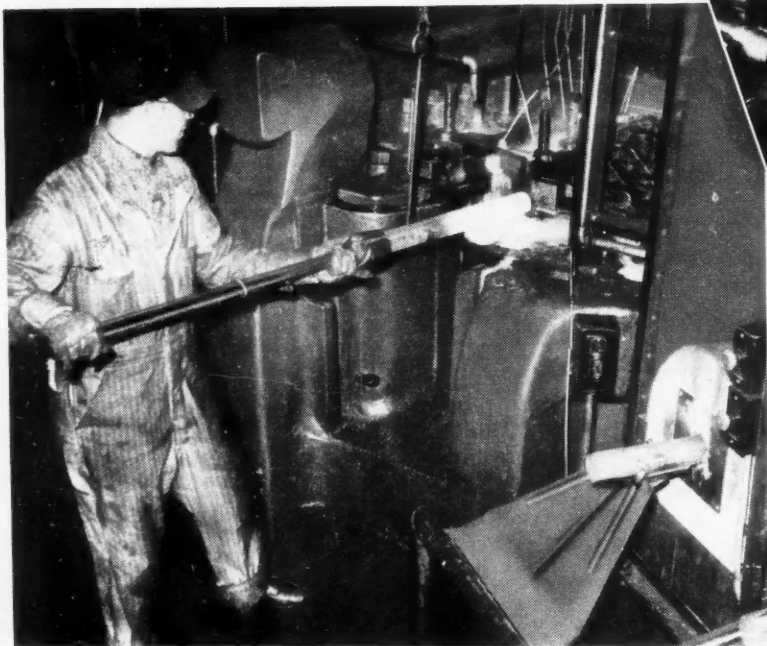
Operation No.	Description	Operation No.	Description	Operation No.	Description
1.	Shear to length Buffalo shear	17.	Finish turn outside dia. Finish cam turn 8 deg. 45 deg. angle—finish cam turn 25 in. radius Cleveland 8 spindle turning machine	26.	Finish turn rotating band Cleveland rigid lathe
2.	Polish end of bar for etching	18.	Check for porosity Hydraulic press—75 ton	27.	Weld metal disc on closed end Thompson Gibbs seam welder
3.	Etch and rinse	19.	Drill 0.257 (F) and tap 5/16—18 2 spindle Avey drill	28.	Wash, rinse and dry Schmieg washer
4.	Inspect	20.	On closed end semi-finish face—finish face break corner and remove centering base on open end semi-finish face, finish face semi-finish bore for threads—cut 2 in.—12 threads Bullard multimatric machine	29.	Final inspection Sheffield multicheck electric gage Rickert & Shafer thread checker
5.	Load on monorail	21.	Mill (5) staking notches in open end Kent-Owen hand mill	30.	Assemble set screw with vaseline on threads
6.	Heat for upset Induction heater	22.	Knurl band seat Morley knurling machine	31.	Stamp complete and apply vaseline on threads Martin marking machine
7.	Upset No. 6 Ajax forge machine	23.	Check for weight	32.	Spray complete and pack in carton Devilbiss spray machine
8.	Shear off tong hold and peen tip No. 57 Toledo press	24.	Machine when necessary for volume Lehmann engine lathe	33.	Make up carton
9.	Inspect	25.	Assemble rotating band and press into shape West hydraulic shell banding press	34.	Final inspect cavity
10.	Shot blast Shot blast machine			35.	Seal top of carton and stamp weight, etc.
11.	Inspect			36.	Blank No. 7 Minster press
12.	Center closed end			37.	Wash Schmieg washer
13.	Rough turn outside diameter—rough cam turn closed end—rough face closed end and turn centered boss Excello vertical lathe			38.	To be welded to 105 mm shell
14.	Inspect				
15.	Restrike to form open end Bliss press				
16.	Rough bore and face open end New Britain 4 spindle auto Lehmann lathe				

Operations on 75MM Shells

Operation No.	Description
1.	Shear to length Buffalo shear F-320
2.	Polish end of bar for etching
3.	Etch and rinse
4.	Inspect
5.	Load on monorail
6.	Heat for upset Induction heater
7.	Upset No. 4 in. National forging machine
8.	Shear off tong hold and peen tip No. 57 Toledo press
9.	Inspect
10.	Shot blast Shot blast mach. F-213
11.	Inspect
12.	Center closed end Lemaire centering mach.
13.	Rough turn outside diameter cam turn closed end—rough face open end—rough face closed end—turn center plug to 1 in. dia. and chamfer open end Excello vertical lathe
14.	Inspect
15.	Restrike to form open end Bliss press
16.	Finish turn outside diameter—finish cam turn closed end Cleveland 8 spindle turning machine
17.	Check for porosity
18.	Drill and tap 5/16—18 hole 2 spindle Avey drill
19.	Rough face closed end—form cut band seat—cut crimp groove and remove end plug

Operation No.	Description
	—finish face closed end—chamfer and rough bore open end—finish bore, face and chamfer open—thread New Britain 8 spindle chucking mach.
20.	Mill (5) notches in open end Kent-Owen hand miller
21.	Knurl band seat Morley band knurling mach.
22.	Check weight and inspect Scales
23.	Assemble rotating band West hydraulic banding press
24.	Turn outside die of rotating band form and chamfer both ends Cleveland rigid turning machine
25.	Weld metal disc to shell Thompson Gibbs welder
26.	Wash, rinse, and dry

Operation No.	Description
27.	Final inspection Sheffield multicheck electrige Rickert-Shafer thread checker
28.	Assemble set screw with vaseline on threads Screw driver
29.	Stamp complete and apply vaseline on threads Martin marking machine
30.	Spray complete and pack shells in carton Devilbiss spraying machine
31.	Make up cartons Tape machine
32.	Final inspection of cavity
33.	Seal top of carton and stamp weight on side of carton
34.	Blank No. 7 Minster press
35.	Wash Schmiege washer
36.	To be welded to 75 mm shell



(Above) Forge shop and machine shop handling operations are completely mechanized with a modern, heavy duty overhead monorail conveyor line. This view shows the method of transporting 75 mm shell blanks in the machine shop.

(Left) Billets are heated to a temperature of 2350 deg. F., in one of the induction heating furnaces at the right, then are loaded into the upsetting machine at the left.

A battery of familiar, 8-spindle chucking machines are employed for the rough-facing of the closed end, forming the band seat, cutting the crimping groove and removing end plug, finish-facing closed end, chamfer and rough boring of the open end, finish-boring, facing and chamfering the open end, and threading.

Five notches are milled in the open end, for staking later on, in a hand miller, then the band seat is knurled in a special band knurling machine. Shells are now checked for weight and volume.

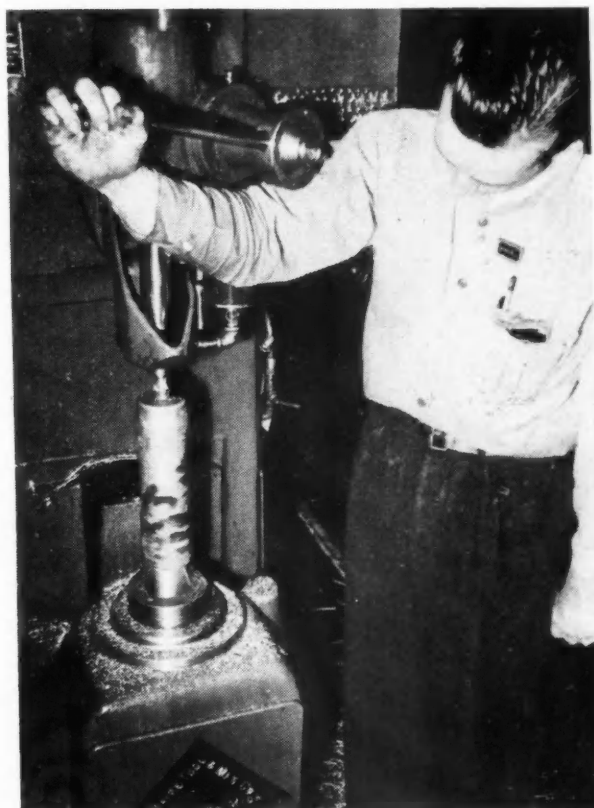
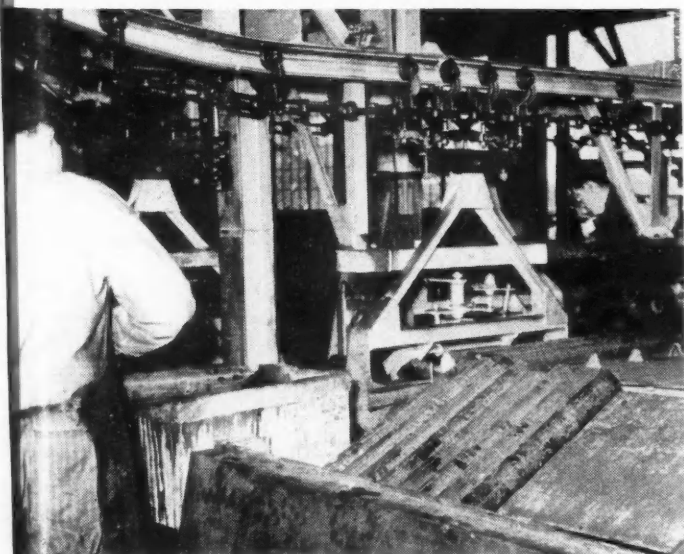
The brass rotating band is pressed in place on a hydraulic banding press, being squeezed in place in three indexing operations. The outside diameter of the brass band is turned to size and chamfered at both ends on one of a battery of single-spindle Rigid-turner machines.

The next operation, that of seam welding a thin steel disc on the closed end is most interesting from a technical standpoint. Experience gained in World War I indicated that perhaps one shell out of 50,000 rounds had a tendency to explode prematurely due to the presence of fine seams running axially from the cavity to the outside of the closed end. Sole function of the welded disc is to seal the closed end and thus safeguard against any possible failure. The welding is done on one of a battery of resistance welders, using two small rotating disc electrodes, and accurately timed by split cycle timers.

The shell is then washed, rinsed, and dried, proceeds to the final inspection bench, where it is checked dimensionally in a special electric gage while the thread is inspected with a thread checker. The gage checks eight different dimensions on the body of the shell, indicating acceptance by amber lights for each point, green for oversize, red for undersize, providing a qualitative check which can then be verified by the use of micrometer gages.

The final steps consist of a series of minor operations preparatory to packing by Government inspec-

After the billets have been sheared, they are prepared for inspection by etching to assure freedom from seams and other imperfections.



First operation in the machine shop is the centering of the shell blank on one of a battery of special centering machines. The shell is aligned for this operation from the open end cavity.

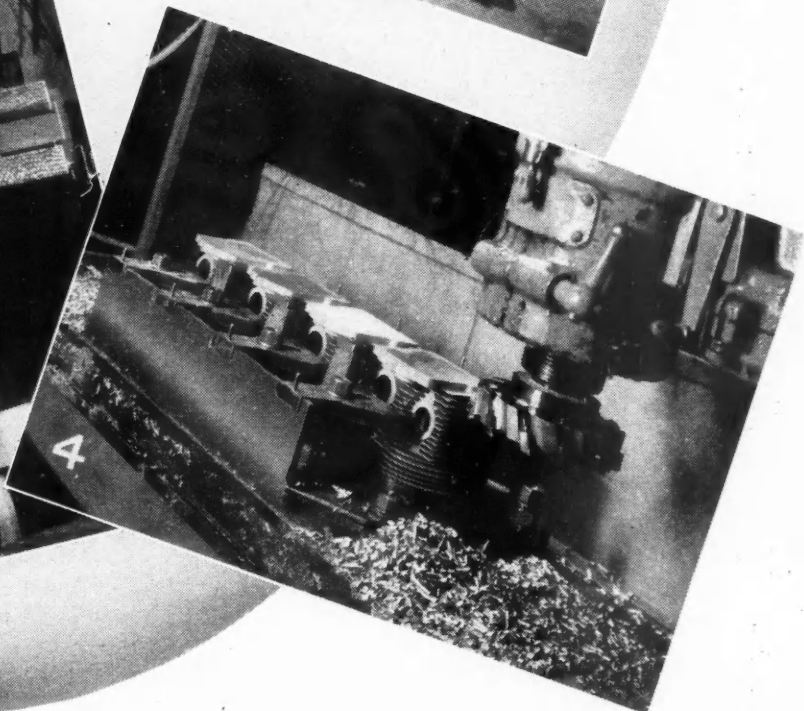
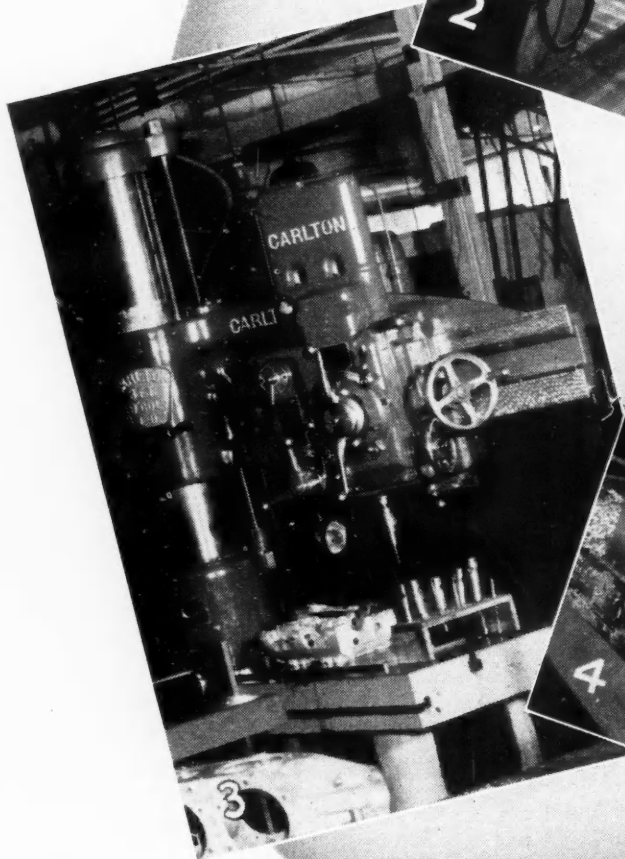
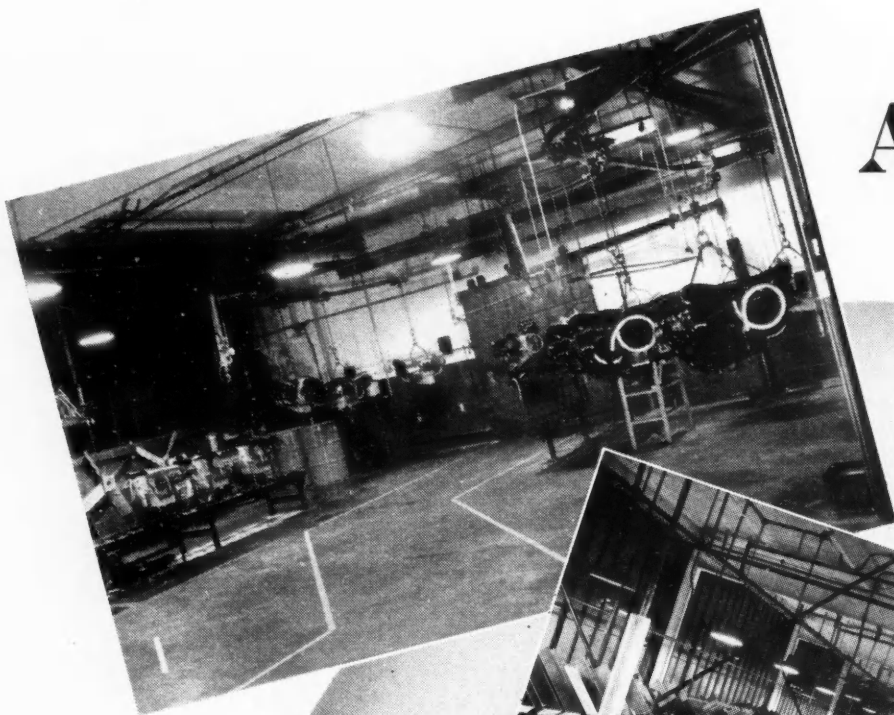
tors. First is the assembly of set screws and the application of vaseline to protect the thread in storage. Then stamping of the shell in a marking machine for identification. The shell is then sprayed in an automatic rotating fixture spraying machine in which the interior is coated with an acid-resisting asphaltum paint by a spray nozzle moving vertically within the cavity. Simultaneously, the exterior is coated with a special yellow quick-drying lacquer by means of three spray nozzles.

This is followed by visual inspection, then sealing in standard cartons which are suitably marked and stamped with the weight of the container.

As mentioned earlier, the fabrication of the 105 mm. shell follows the same pattern save for a few items of special equipment. The rough-boring and facing of the open end, an extra operation after cold-chasing on the big size, is done on a four-spindle automatic chucking machine. The operations of semi-finish and finish-facing and threading, handled on 8-spindle automatic chucking machines on the 75 mm. shell, are done on the big 8-station vertical turret lathes in the case of the 105 mm. size.

Finally, it is of interest to emphasize again that the GM Forge procedure requires no metal cutting operations on the shell cavity due to the precision with which the forging job is done. As a matter of fact, it is quite amazing to find that the forged cavity will run within plus or minus 0.015 on run-out as checked by sensitive gages.

Aircooled



Motors' Production Line Displays

Adaptability

TRACING its beginnings to the time-tried principle of the Franklin air-cooled engine, Aircooled Motors Corp., Syracuse, N. Y., owes its present position in the industry to the pioneering efforts of Franklin engineers who visualized the economic place for the small, high performance engine in private airplanes of modest size and cost.

Although starting from scratch, the company today is one of the principal producers of small air-cooled power plants that fly. In a productive floor space of some 35,000 sq. ft., there is a capacity for building 32 engines per day, thus fitting into the program of the leading producers of small planes.

A few years ago the energies of the organization were concentrated on the manufacture of four-cylinder flat engines developing 50 hp. Later the power range was extended by the use of a larger cylinder bore; today, this range has been further expanded by the recent introduction of a six-cylinder engine rated up to 135 hp. Currently there has come the development of a unique reduction gear which promises a still wider range of useful power; and in the background is a research project promising to produce a novel type of supercharger.

At this writing, there is a basic line consisting of two fours and two sixes constituting perhaps a score of different models when all of the options of cylinder size, accessories, and attachments are taken into ac-

count. Largely as a result of the close cooperation between engineering and production characteristic of a small organization, the product has been so designed as to provide the maximum of interchangeability with a minimum number of different parts for the gamut of engine models.

Thus the cylinder barrels and heads are made in but two sizes, using two basic bores—4 in. and 4¼ in.—completely interchangeable on fours and sixes. For the four basic engines they have two barrels, two heads, two connecting rods, and eight crankcases, the increase in number in the latter being due to the growing adop-

tion of gear reduction units. From this outline, it is obvious that simplification of the basic elements is the key to the economic operation of the set-up.

As might be expected, production skills and native ingenuity play important rôles in the management of the manufacturing department. Attention

*This is the Sixty-first
in the series of monthly
production features*

to minute details and improvisation of methods are the stock in trade of the executives engaged in this activity. For example, the biggest job from the standpoint of multiplicity of operations is that of making crankcases. This is done for the most part on general purpose drilling machines with fixtures and tooling so designed as to handle all eight cases over the same line with but simple adjustments and with the minimum of spindle changes.

Perhaps the most impressive feature in this regard is the development of interchangeable fixtures and standard die plates on the drill presses, provided with eccentric bushings and dowel pins which permit of quick adjustment to accommodate the different cases. These die plates have one characteristic in common—husky guide posts that assure a precise and accurate alignment of the work. In some of the later designs, the die plates have a heavy post on one end and a smaller guide post on the other to facilitate the correct positioning of the work. These are found on end drilling operations where two blocks are handled at a time.

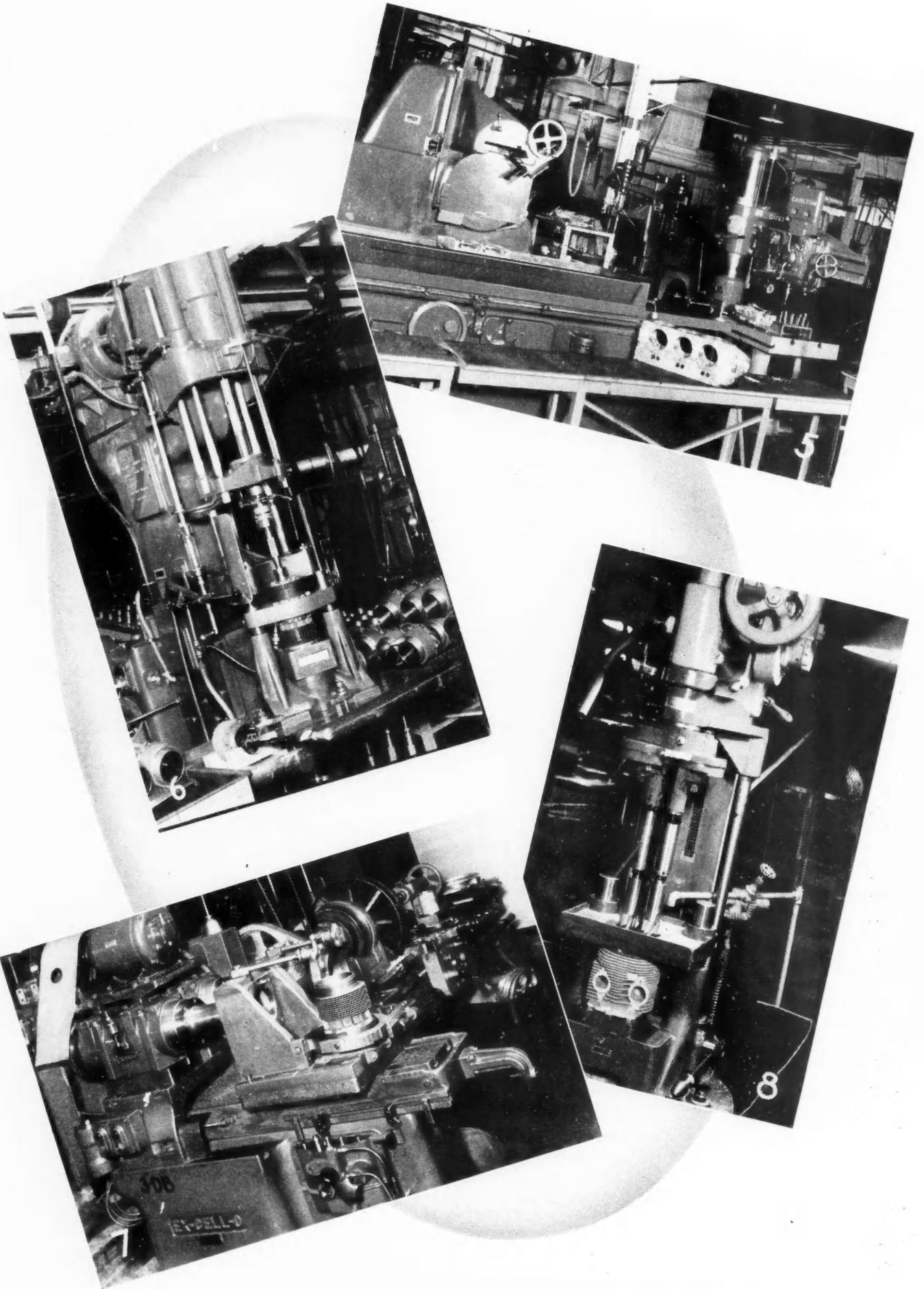
Over a period of years, they have demonstrated the

1. Rear section of the assembly department showing the end of the motor assembly line at the extreme left. The Curtis air hoist for transferring engines from the assembly conveyor to the overhead trolley may be seen in the background. In the foreground, at the right, are some finished engines awaiting final O.K., while suspended from the overhead trolley system.

2. Looking down the Aircooled motors assembly line. In the foreground—the steam cleaning chamber; over the gravity roller conveyor are the stock bins containing small parts and fastenings stored at points of usage; at the right—the sub-assembly stations.

3. This 3-foot Carlton radial drill handles many precision tapping operations.

4. Milling of the top surface of cylinder heads is done on a general purpose Brown & Sharpe milling machine, four heads at a time in the special fixture.



5. Versatile Thompson surface grinder is used for finishing the faces of crankcases and other parts of the engine.

6. Barnes Drill Co., honing machine, fitted with hydraulically-operated Micromatic tools is used for honing cylinder barrel bores. Note the block and internal gage for bore size inspection on the table at the left.

7. Ex-Cell-O precision boring machine for boring cylinder barrels. One head takes 4 in. bores, the other takes 4 1/4 in. bores.

8. Superior power drill with Hoefer multiple drilling head set up for boring and facing on the cylinder head. Note the massive drilling fixture with the husky guide posts to assure perfect alignment of the work.

utility and reliability of the relatively inexpensive drilling heads such as are made by Buffalo and Delta. These are mounted on suitable tables in vertical, horizontal, angular, or inverted positions, thus producing specialized drilling equipment of amazing versatility. Another economical device is the use of Hoefer multiple spindle drilling attachments for single spindle drill presses. These units have adjustable spindle spacing, lend themselves to wide product changes without added expense.

Carboloy tooling is extensively used in the machining of cast iron and aluminum, latest development being the adoption of Carboloy-tipped reamers which have extended the useful life of the reamers many times over.

Although the backbone of factory equipment is composed of older machines of familiar makes, the recent expansion program has resulted in the acquisition of many items of new equipment of the most modern character—Ex-Cell-O precision boring machines, Potter & Johnston turret lathes, Jones & Lamson turret

lathes, a big Thompson surface grinder, a Carlton radial drill, Edlund precision tapper, and the like.

The production department is particularly proud of its line-up for the machining of cylinder barrels and cylinder heads. These are representative of modern aircraft practice and in the opinion of the management, constitute among the fastest and most economical processes known to the art.

Magnaflux testing equipment, familiar in most plants today, is used for the inspection of cylinder barrels, crankshafts, connecting rods, and wrist pins, has attachments for exploring the periphery of cylindrical parts as well as for the longitudinal surfaces of pins and cranks.

Another example of modernity is found in the use of infra-red lamps for the rapid and economical heating and baking of parts. A small tunnel oven of infra-red lamps is used for the drying of finished engines before enamel-spraying, then for baking the enamel. A small heating chamber installed on a sub-assembly bench is employed for the heating of pistons to facilitate the installation of wrist pins. A similar chamber takes care of the shrink-fit assembly of rocker support pins and blocks. These shop kinks are well worth the attention of production men who may be faced with problems of analagous nature.

Speaking of shop kinks, note the use of the inexpensive automotive type air brake cylinders for various kinds of clamping devices. A pair of small cylinders mounted on a milling machine provide for the rapid clamping of connecting rods; a large air brake cylinder constitutes the major element of the cylinder and head assembly testing fixture. In the latter case, the cylinder not only clamps the assembly securely in the fixture but also supplies the air pressure for locating water leaks while immersed in the tank.

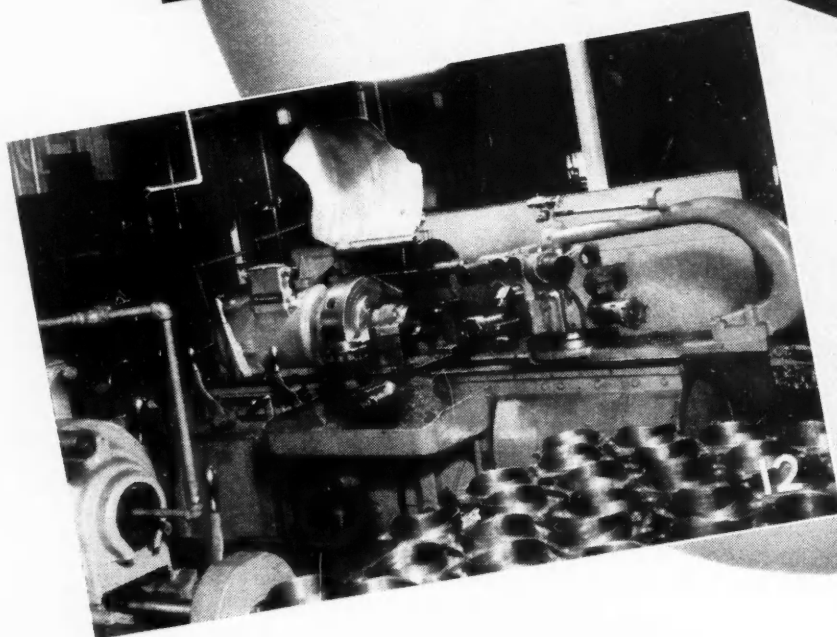
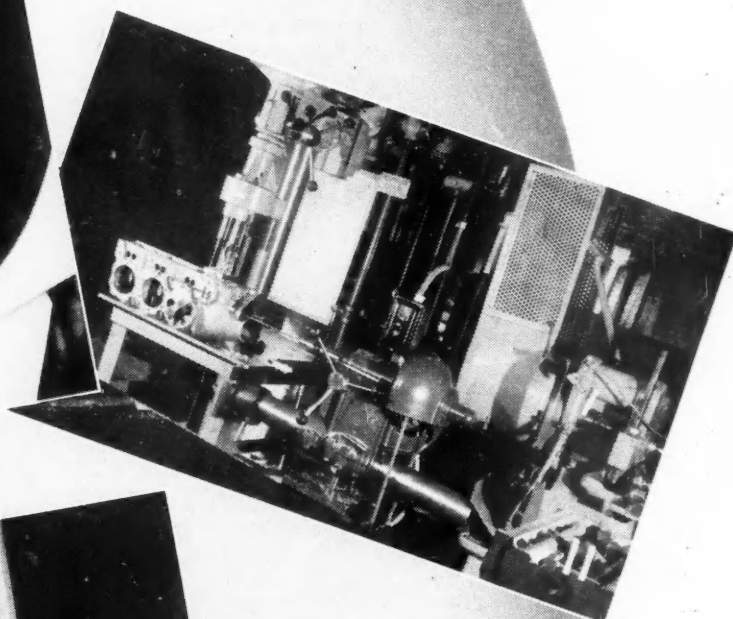
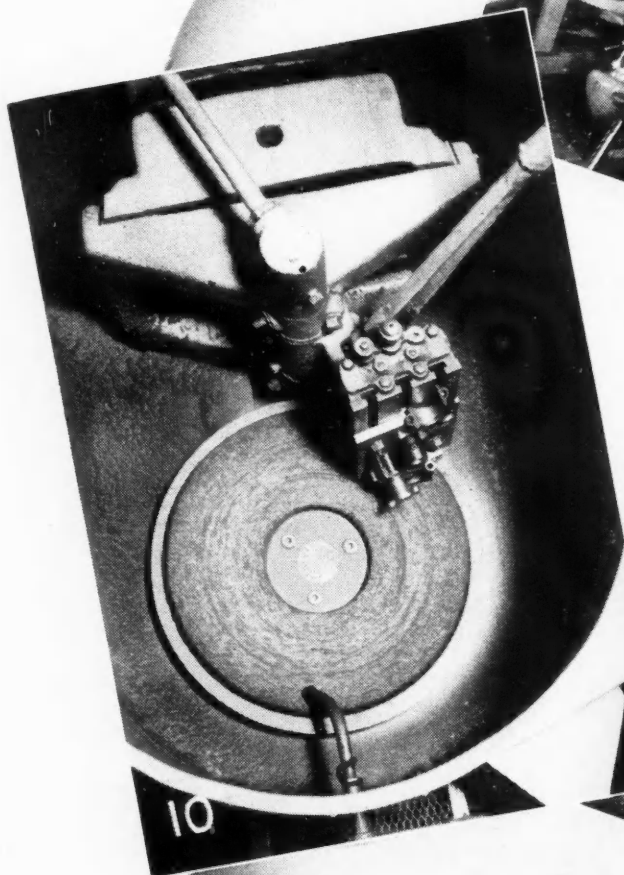
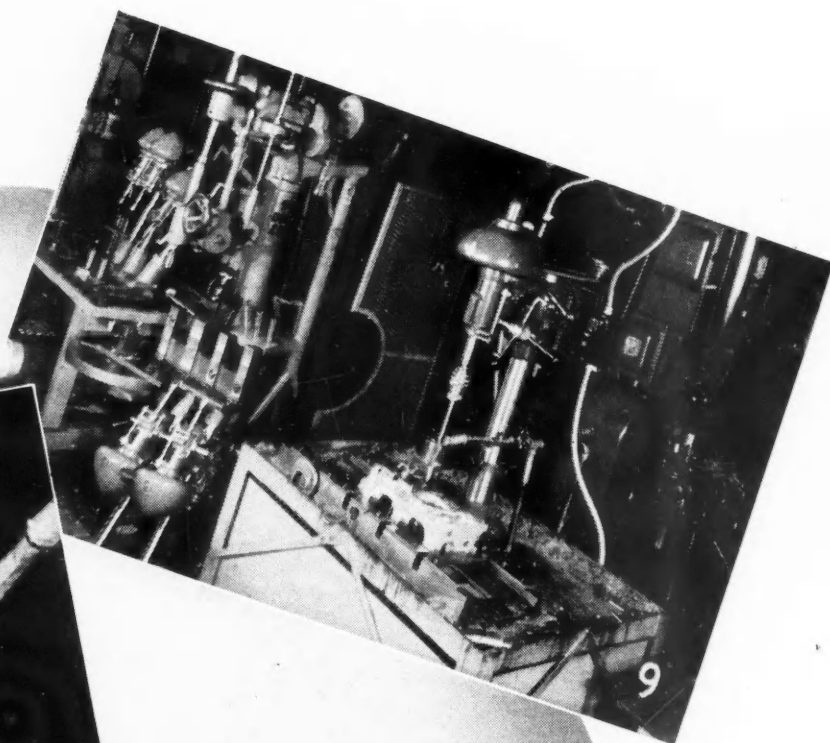
Factory Routing Half Crankcase

OPERATION AND EQUIPMENT

MILL inside faces
Ingersoll planer type mill
DRILL and **REAM** dowel holes
Carlton radial drill
MILL cylinder bosses, top and bottom
Ingersoll planer type mill
BORE cylinder holes
Moline Hole-Hog
MILL oil seals
Brown & Sharpe No. 12 horizontal mill
Rough **MILL** sides of main and thrust bearings
Brown & Sharpe No. 13 horizontal mill
DRILL cylinder hold-down stud holes
Baush multiple drill
DRILL all inside holes
Harrington multiple drill
Rough **BORE** cam and crankshaft bearing bores
DRILL long oil hole
Rockford horizontal drill
DRILL lifter holes
Foote-Burt gang drill
REAM lifter holes
Foote-Burt gang drill
DRILL angular holes through lifter holes
Natco multiple drill
CHAMFER lifter holes on outside and inside
HONE lifter holes
Buffalo drill—special set-up

OPERATION AND EQUIPMENT

DRILL oil hole to lifter header, **DRILL** and **REAM** for fuel pump plunger
Delta speed drill
DRILL and **REAM** breather hole
Barnes 26 in. power drill
Back **SPOTFACE** bearing stud hole bosses
Buffalo speed drills, inverted
CHAMFER all tapped holes, **REAM** dowel holes for motor support and **TAP** one pipe tap hole
Hammond wall drill
COUNTERBORE for oil seals
Hammond wall drill
CUT bearing locks
Buffalo drill
SPOTFACE outside holes
Hammond wall drill
TAP main bearing and cylinder hold-down stud holes
Carlton radial drill
GRIND inside joint face
Thompson surface grinder
DRILL thrust washer pin holes
Special drill table
Finish **REAM** dowel holes
Hammond wall drill
BURR complete
DRIVE necessary studs
Carlton radial drill
INSPECT



9. Some excellent examples of specialized utilization of drill heads. At the extreme right is a Buffalo head fitted with a Micromatic honing tool for honing valve lifter bores in the crankcase half. At the left are special drilling machines made by installing Delta heads in various positions.

10. Close-up of the Gardner disk grinder used for grinding the surfaces of con rods and cans.

11. Special drill press set up emphasizing the utility of the Buffalo drill head which may be seen attached at the right. This is an operation on the six-cylinder crankcase with reduction gear attachment.

12. Boring, facing flange, and turning pilot of cylinder barrel on a Potter & Johnson heavy-duty turret lathe

Plant Layout

The plant layout is relatively simple in character. It may be considered as being divided into four major sections—the front section, containing all of the machine shop operations; a second section devoted to receiving and production stores; a third section containing the assembly department and shipping; and the last section, comprising a bank of test cells.

The machine shop department is housed in a

Factory Routing Cylinder Head

OPERATION AND EQUIPMENT

FACE, BORE dome and **THREAD**
Jones & Lamson No. 5 lathe
MILL top
Brown & Sharpe No. 5 vertical mill
DRILL and **REAM** guide holes
Foote-Burt gang drill
CUT clearance around valve seat
No. 2 LeBlond universal mill
CUT valve seats
Barnes 26 in. power drill
BORE intake port hole and **FACE** exhaust hole
Superior 26 in. power drill
DRILL and **COUNTERBORE** lifter holes
Barnes Drill Co. No. 26 power drill
DRILL, COUNTERBORE, CHAMFER and **TAP** spark plug holes
Barnes Drill Co. 26 in. power drill
COUNTERBORE for spring seats
Barnes Drill Co. 26 in. power drill
DRILL valve cover screw holes, rocker support
Baush multi drill
DRILL and **TAP** primer holes
Buffalo speed drill
DRILL oil holes for rockers, **DRIP** pipe tap hole
Buffalo speed drill
COUNTERSINK and **TAP** necessary holes in cylinder head
Buffalo speed drill tapping head
Hand **REAM** valve seats
Bench
BURR complete
WASH and remove chips
Wash
Tank
INSPECT

Factory Routing Connecting Rod

OPERATION AND EQUIPMENT

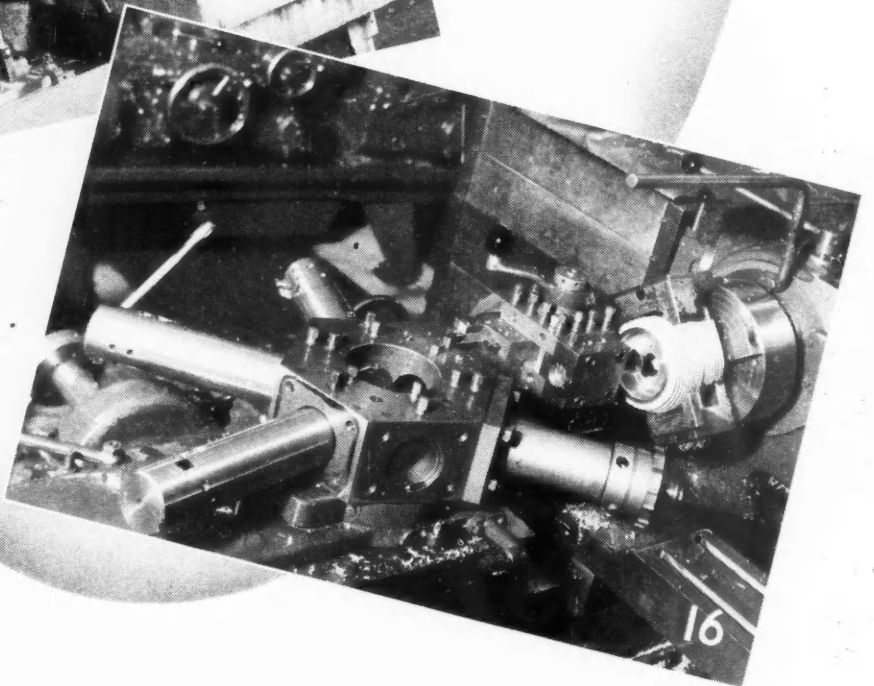
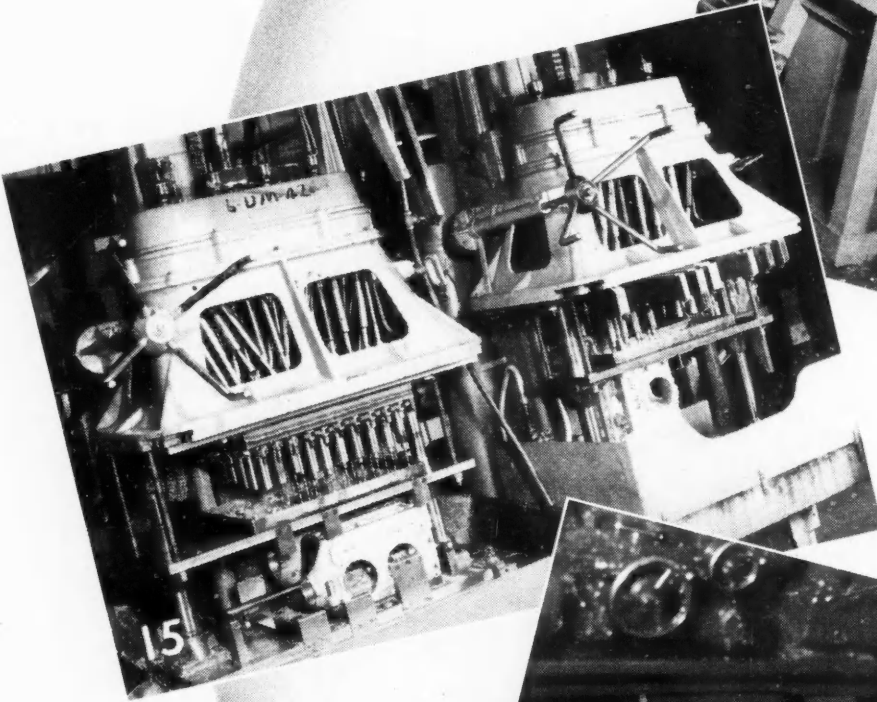
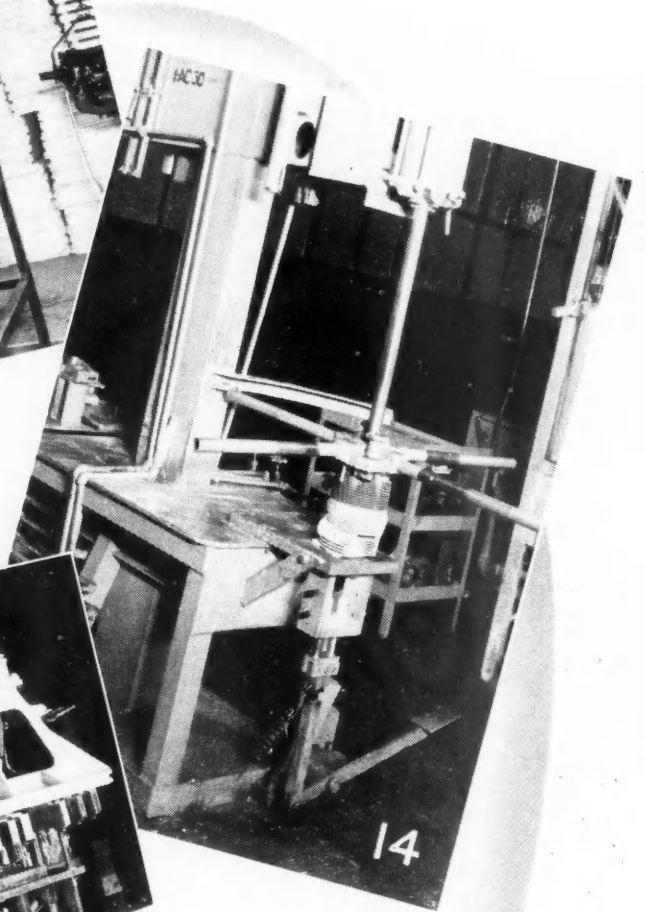
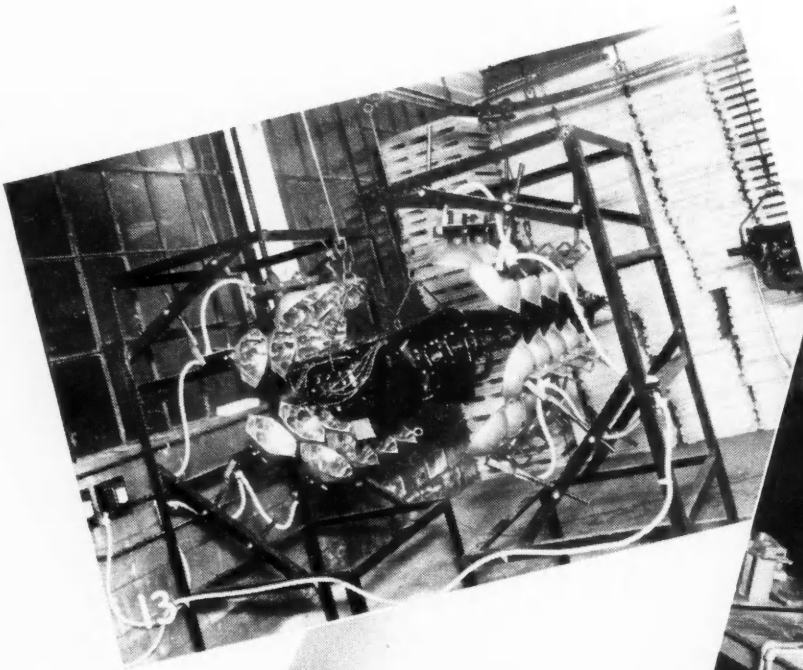
MILL locating bosses on large end and one side of wrist pin end
Brown & Sharpe No. 12 horizontal mill
DRILL large bore to 2 in. diameter
Baker power drill
DRILL and ream wrist pin hole
Minster No. 9 power drill
SPOTFACE other side of wrist pin hole to size
Barnes 20 in. power drill
DRILL and **COUNTERSINK** three oil holes in wrist pin end
Buffalo speed drill
DRILL and **REAM** bolt holes and **CHAMFER** wrist pin hole
Natco multiple spindle drill
MILL face for bolt head and **SAW** apart
Cincinnati No. 3 power mill
COUNTERBORE for bolt heads in large end of connecting rod
Buffalo speed drill
Disk grind joint faces
Gardner disk grinder
SPOTFACE and **CUT** 20 deg. relief for bolt holes
Barnes 24 in. power drill
ASSEMBLE rod and cap
Electric nut driver
PRESS bushing wrist pin end and **BURNISH**
Air-operated Arbor press
Semi-finish **REAM** large bore
Minster No. 9 power drill
Finish **FACE** both ends of large bore
Monarch 18 in. lathe
Finish **BORE** crank and wrist pin holes
Ex-Cell-O boring machine
DRILL two oil holes in large end of connecting rod
Buffalo speed drill
DISASSEMBLE and **CHAMFER** both oil holes
Bench
MILL bearing lock in rod and cap
B & S hand miller
BURR and **REASSEMBLE**
Bench
INSPECT

large, almost square area, with a central section devoted to the tool room, with production departments on each side wall and across the rear end. Looking down the machine shop we can trace the major departments about in the following order: at the extreme left is a corner for the experimental pattern shop, then the crankcase line, and finally the oil pan and dual cover at the rear and extending across the center aisle. On the right, beginning at the rear end are departments for machining oil pumps, oil pump covers, and engine mounting brackets; starter and generator gear covers; the cylinder barrel line; cylinder barrel and head assembly; cylinder head line; connecting rods; and finally the rocker arm department at the front end.

After final inspection, the finished component parts are stored in the production stores department from which they are drawn out according to schedule for the final assembly line.

Machine Operations

Consider first the crankcase routing. We have reproduced the routing for one half of the case, the other half being made in substantially the same fashion and routed over the same machinery. Some pieces of equipment on this line are of more than passing interest. Here, for example, is a Buffalo drilling head fitted with a Micromatic hone and used for honing valve lifter holes. Another set-up employing two



Buffalo heads inverted under a plane steel table is used for back spot-facing. A feature of this equipment is the application of a Cutler-Hammer brake on each drive to stop the driving mechanism quickly.

Among the Delta heads is one arrangement for cutting bearing locks, utilizing a standard drill press keyseating attachment for the purpose. Another interesting detail on main line boring is the use of a Davis boring bar with micrometer adjustment for the fly-cutters, all of which are Carboloy-tipped.

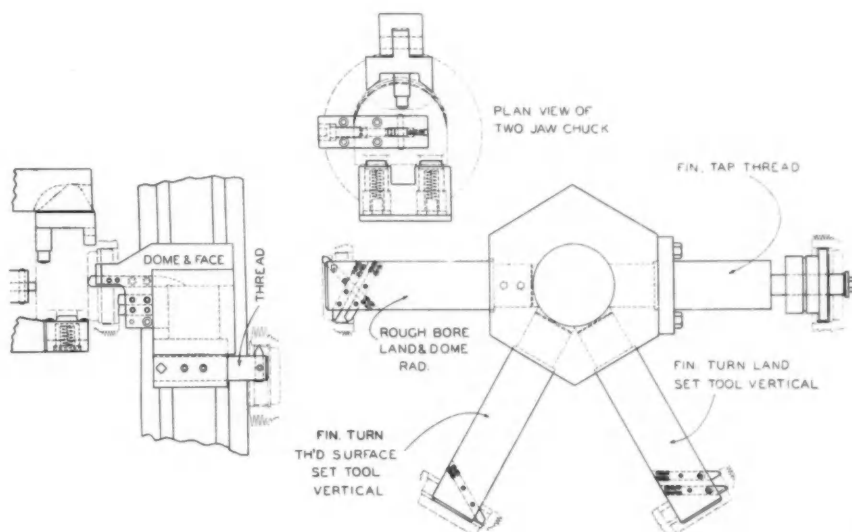
After both halves of the case have been machined, they are assembled into the crankcase assembly and subjected to a series of finishing operations including: boring of main and cam bearing bores; facing ends, back facing of bearings, and a variety of drilling and tapping operations.

Precision tapping is handled on a special Edlund drill and on a 3-ft. Carlton radial with a 9-in. column.

A number of Jones & Lamson turret lathes are used in various departments. One of these, fitted with an ingeniously designed indexing fixture, handles the machining of the oil pump body. In a single setting, this machine bores, drills, and reams the part.

Machine lines for the cylinder heads and cylinder barrels are laid out in parallel rows, one for 4-in. bores, the other for 4¼-in. bores. However, the tooling can be quickly changed over to permit the machining of a single bore if maximum production of one size were imperative.

On the cylinder barrel, the principal operations of boring, facing, and turning are done on a Potter



Tool layout for the J & L cylinder head machining set-up, said to be one of the best examples of its kind in the industry.

& Johnston turret lathe, while turning the face and forming the thread are handled on two Jones & Lamson lathes. The bore then is precision-bored on an Ex-Cell-O boring machine which is fitted with two heads—one for the 4-in. bore, the other for the 4¼-in. bore. Bores are honed in two operations on a Barnes honing machine fitted with Micromatic tools, surface finish being held to a reading of three micro inches (rms).

The cylinder head, which is made of aluminum Y-metal alloy, is machined almost entirely with Carboloy-tipped tools. Easily the most important set-up is that for facing, doming, and threading in a No. 3 Jones & Lamson lathe. Two of these machines are found here—one for the 4-in. bore, the

other for the 4¼-in. bore. Details of these operations will be found on the special tool layout reproduced elsewhere. Particularly noteworthy is the formation of the positioned precision thread for fitting to the barrel. It is cut in seven distinct passes of the tool, then chased by hand with a special cylindrically-ground top, holding the P.D. to 0.002 in. and to a concentricity of plus or minus 0.0005 in. The Carboloy-tipped doming tool is good for 800 pieces per grind.

After machining, the barrel and head are assembled in a rather simple type of fixture, illustrated in the pictorial section. For this operation, a head is heated to 550 deg. F., in the oven, then placed in an inverted position in the assembly fixture, fitted with the necessary inserts. A Curtis air cylinder is employed to hold

(Turn to page 64, please)

Routing Cylinder Barrel

OPERATION AND EQUIPMENT

PAINT	
BORE, FACE	flange and TURN pilot on flange end
	Potter & Johnston No. 6-A turret lathe
DRILL	flange holes
	Natco multiple spindle drill
TURN FACE and CUT	threads
	Jones & Lamson No. 5 lathe
BORE	cylinder barrel, leaving stock for hone
	Ex-Cell-O boring machine
SPOTFACE	flange holes
	Buffalo drill—special, inverted
HONE	cylinder barrel
	Barnes Drill Co. cylinder honing machine
INSPECT and MAGNAFLUX	

13. Versatile infra-red tunnel type heating oven. It dries steam-washed engines; it bakes sprayed-on finish. Note that the motors are transported on an overhead trolley line which is a part of the conveyor system in the assembly department.

14. Fixture for assembly of head and barrel, shown at the end of the operation. The large Curtis air cylinder for holding down the head during this operation may be seen directly overhead. The furnace for heating the heads is at the left in the background just out of this view.

15. Part of a battery of Natco multiple drills in the crankcase line, showing the steel die plates and use of heavy guide posts.

16. Primary operation on the cylinder head is found on this Jones & Lamson turret lathe which is tooled for facing, forming, and threading.

The Facts About the East

THE THREATENED shortage of petroleum supplies in the East has probably been considerably overstressed. After the first of the year the situation will be greatly relieved, assuming that additional tanker tonnage is not withdrawn from the United States and other Western Hemisphere services.

A careful study has been made by the American Petroleum Institute and submitted to Oil Administrator Harold L. Ickes. The easing of the situation will come about chiefly through more use of pipelines despite the higher cost of this mode of transport, and employment of tankers now under construction. The API estimates an Atlantic Seaboard tanker shortage of 300,000 deadweight tons during the 1941 third quarter, a rise to a peak of 636,000 tons in the final quarter, an easing to 547,000 tons in the first quarter of 1942 and a drop to 105,000 tons in the last three quarters of next year. About 95 per cent of all petroleum distributed along the Atlantic Seaboard is hauled by tankers. About 15 new tankers will be available to the industry later this year, not including construction for the government, and 43 next year.

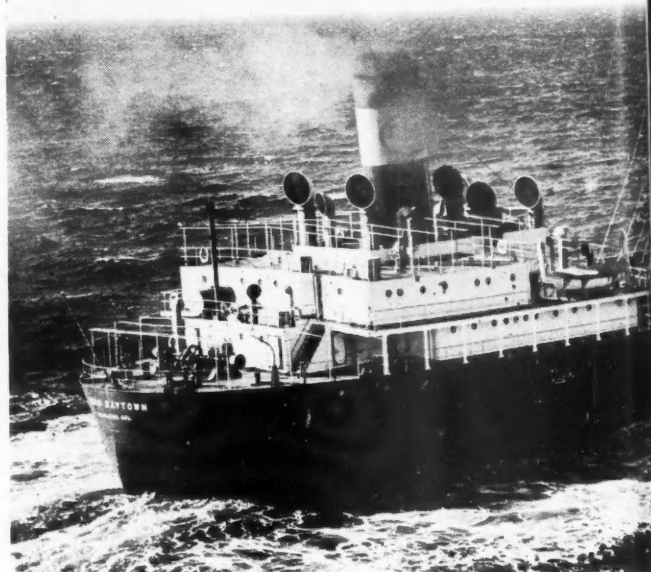
The threatened shortage has been occasioned by the transfer to Great Britain of 50 tankers previously used in the intercoastal trade and in carrying oil from Gulf ports to the East Coast, reducing to 220 the number in that service. The transfer of these tankers to Great Britain cut about 70,000,000 barrels from the annual water-borne supply of oil to the East Coast, which on the average receives 500,000,000 barrels of petroleum products by water from domestic and foreign services.

Looking to comparatively slight but immediate relief, President Roosevelt on June 20 placed all petroleum products under export controls and prohibited shipments from any Atlantic ports, except to the British Empire, Egypt and the Western Hemisphere.

Meanwhile, steps are being considered to ration fuel oil and gasoline. This was one of the major points that Mr. Ickes discussed with oil interests at a meeting on June 19, when he made it known that he was considering the possibility of ration cards for gasoline. All parties are hopeful measures may be devised to avoid rationing.

While Price Administrator Henderson was asking 800 leaders of the oil industry, who had attended the Ickes conference, to put a voluntary ceiling on oil prices at approximately the existing levels, President Roosevelt sent a message to Congress asking that current ship inspection laws be waived, the purpose being, it is said, to allow an increase in the legal load of oil on tankers.

The API report said that the equivalent of 26 tankers—the average tanker is 10,000-ton deadweight



—could be saved by easing the load line limitations, substituting Gulf Coast supplies for intercoastal movement from California, rearrangement of Latin American supplies to shorten hauls, completing two pipelines in the Southeast, and more effective use of barges on river systems.

Taking up the situation by modes of transportation, which is the bottleneck leading to the oil and gasoline shortage problem in the East, the following is the picture.

Tankers

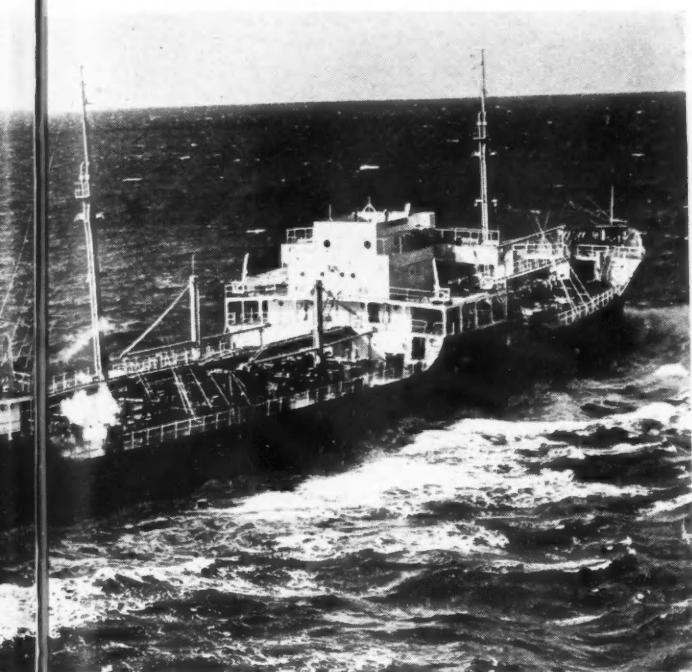
Two years ago the Navy took 12 extra sized, speedy tankers whose construction was subsidized by the Maritime Commission. At that time, however, there was no anticipation of shortage.

The Maritime Commission is using 50 tankers to carry oil from Venezuela, Mexico and Texas to Philadelphia and New York for reshipment by the British in their own tankers. This is the so-called shuttle service.

The oil industry recently proposed a plan to build 36 tankers with its own money if the Maritime Commission will help get the industry OPM priority rat-

Coast

Gasoline Bottleneck



ings for steel. The Commission has said that it will accept the proposal if the industry will build its own shipways, away from present activities, in order not to drain the labor supply. At the earliest, however, these tankers cannot be made available much before a year and a half. They would be under Commission control, and would not be put under a foreign flag if engaged in inter-country service; or would remain under the American flag if engaged in coastwise work.

There are six foreign-flag tankers subject to seizure that could be used for American or British needs. The Maritime Commission has denied that there are any American flag tankers transporting oil to Japan. There have been tankers under foreign registry, owned by American citizens, and chartered by Japan.

There are many tankers under foreign registry that are American oil-company owned. The Commission can call them back to American registry, but is most unlikely to do so because of Britain's pressing needs.

The bill to increase the load line of all ships has passed the House and now is before the Senate Committee on Interstate Commerce. This measure would increase tanker carrying capacity by three per cent.

Various means are being put in effect to shorten the

"turn around" periods between Texas and North Atlantic ports.

There have been three large tankers carrying oil from California to Marcus Hook, Pa., two owned by the Standard Oil Co. of California and one by the Sun Oil Co. At the request of Mr. Ickes these tankers will be diverted to the Gulf Coast-Atlantic service.

Pipe Lines

The Cole bill to speed pipe line construction has passed the House and is before the Senate Committee on Interstate Commerce. Its most important provision grants the power of eminent domain for getting the right of way. A 24-inch crude oil line, and a 20-inch products line from the Texas-Louisiana oil field to the Northeast Coast are under discussion, but they would require so much steel, and be so long in building, that such construction is thus far only in the realm of rather remote possibility.

Passage of the Cole bill will permit completion of a gasoline pipe line from Port St. Joe, Fla., through Georgia to Chattanooga. This construction is practically completed, but the railroads have refused right to cross their lines. The bill would assure this right.

Passage of the Cole bill also will open the way for construction of a gasoline line from Baton Rouge, La., through northern Mississippi, Alabama and Georgia, to Greensboro, N. C. The line may be extended to Norfolk, Va. The contract has been awarded.

There are plans under discussion to link up a number of pipe lines from the Mississippi river, in the St. Louis area, through Indiana, Ohio and Pennsylvania, possibly extending to Buffalo, and then cross down to Marcus Hook, Pa.

Barges

Discussion is under way regarding the building of more barges and using them more effectively on the Ohio river to Pittsburgh and from there carry oil and gasoline by truck, rail or pipe line to the Eastern Seaboard.

Railroads

Mr. Ickes says that the railroads could not haul more than one per cent of the Atlantic Seaboard oil and gasoline requirements. This was his reaction to claims of railroads that they can carry all the oil needed. To the railroad contention that there are 19,000 surplus rail tank cars, Mr. Ickes said that they are antiquated, that the rail transportation costs would be excessive, and even if the tanks were available for service, there are not enough engines to haul them; and that switching service is not adequate.

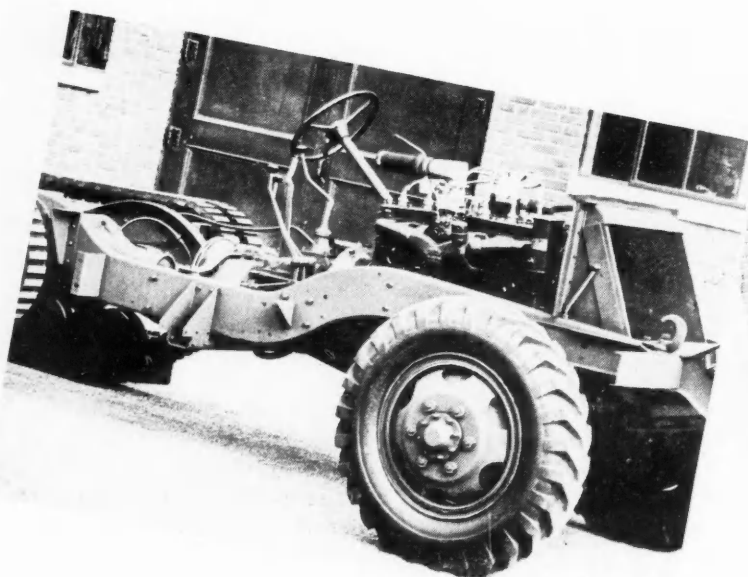
United States



Photos courtesy of White Motor Co. and Autocar Co.

(Above) For scouting ahead of troops and to speed soldiers to combat areas, the U. S. Army will use these Half-Trac armored cars. Three truck manufacturers—White, Autocar and Diamond T—are cooperating in building them to speed production. The initial order calls for 10,147 units, all of which are to be identical to facilitate servicing. They are fully covered with $\frac{1}{4}$ -in. armor plate and when subjected to fire, the armor plate radiator shutters can be lowered, and the windshield and side windows covered with armor plate hinged shields, which have port holes. In action the canvas top is removed. The large roller at the front helps to climb the steep sides of trenches or shell holes. The wheelbase is $135\frac{1}{2}$ in., the overall length 235 in., width $77\frac{1}{4}$ in., and gross weight 17,500 lb.

(Two illustrations below) Powering these cars is the White Super Power six-cyl. engine, which develops 147 b.h.p. and 325 lb.ft. of torque. Its piston displacement is 386 cu. in. Exhaust valves are sodium cooled and accessories include an oil temperature regulator. The transmission and transfer case have eight forward speeds and two reverse speeds. In the hydraulic service brake system is a vacuum booster, which is mounted on the outside of left side rail. The hand brake is the propeller shaft type. A rugged channel type frame extends the full chassis length. Front tires, size 8.25-20, are the self sealing type.

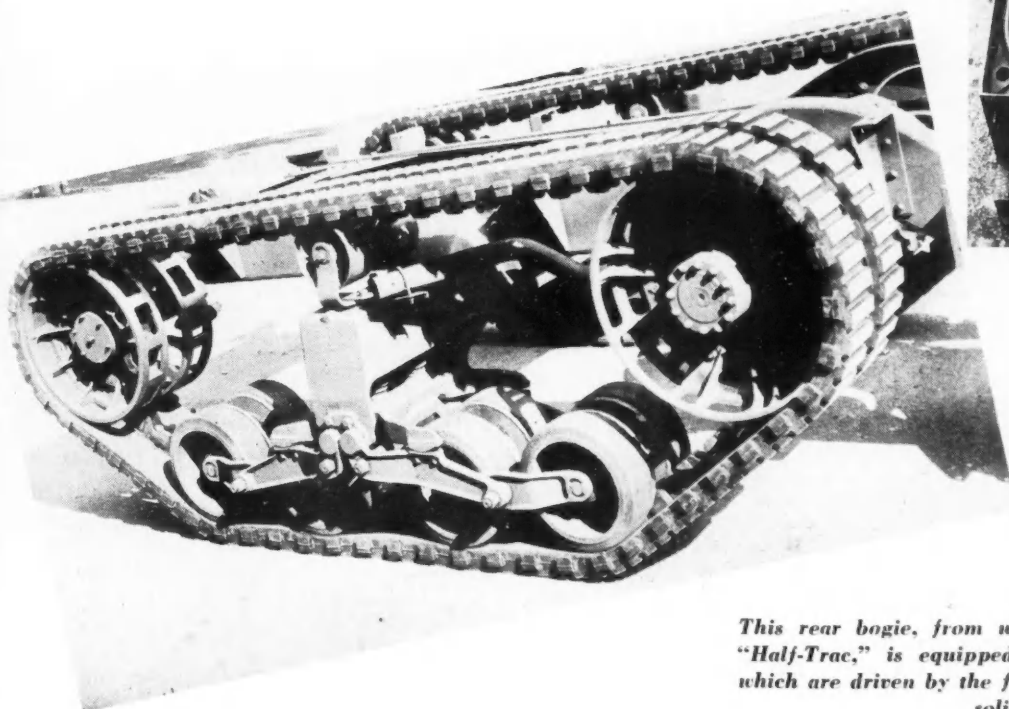
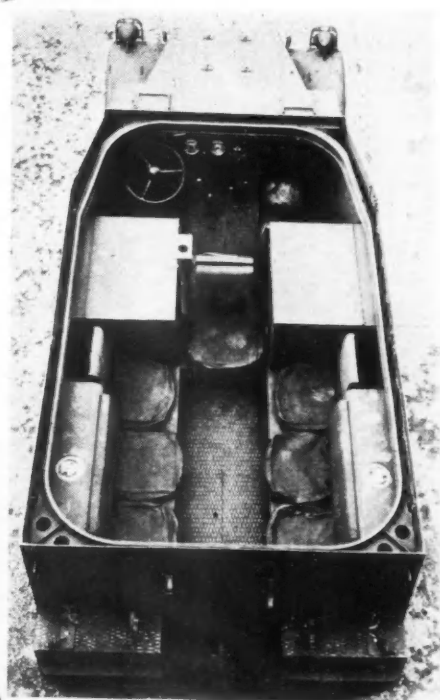


Army Half-Tracs

(Right) Climbing steep embankments, plowing through mud or marshes, and fording streams up to 2½ ft. deep are mere routine for these latest military cars. Over smooth ground or highway they can attain a speed of 50 m.p.h. Power to front wheels and rear tracks is adequate to climb a 60 per cent grade with 10 soldiers and equipment. Their cruising range is 350 miles.



(Right) This view shows the scout car seating arrangement for 10 men, including a crew of eight, driver and car commander. The three seats in the front compartment are not visible here. Encircling the interior at the top is a special gun track for mounting three machine guns, two of .30-cal. and one of .50-cal. Each man is equipped with either a rifle or side arm. Two self sealing fuel tanks, total capacity 60 gal., and a two-way radio outfit are mounted within the armored body.

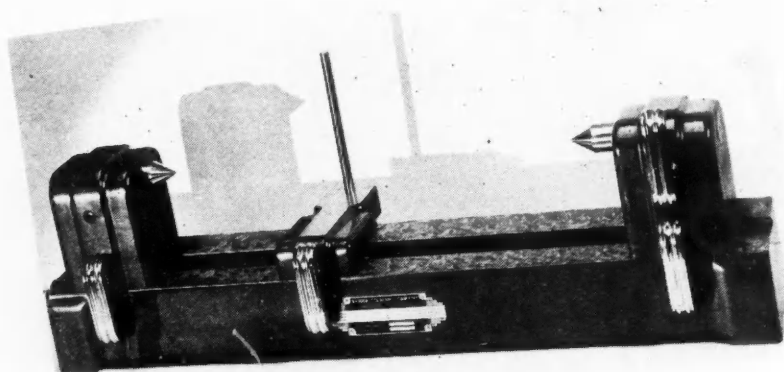
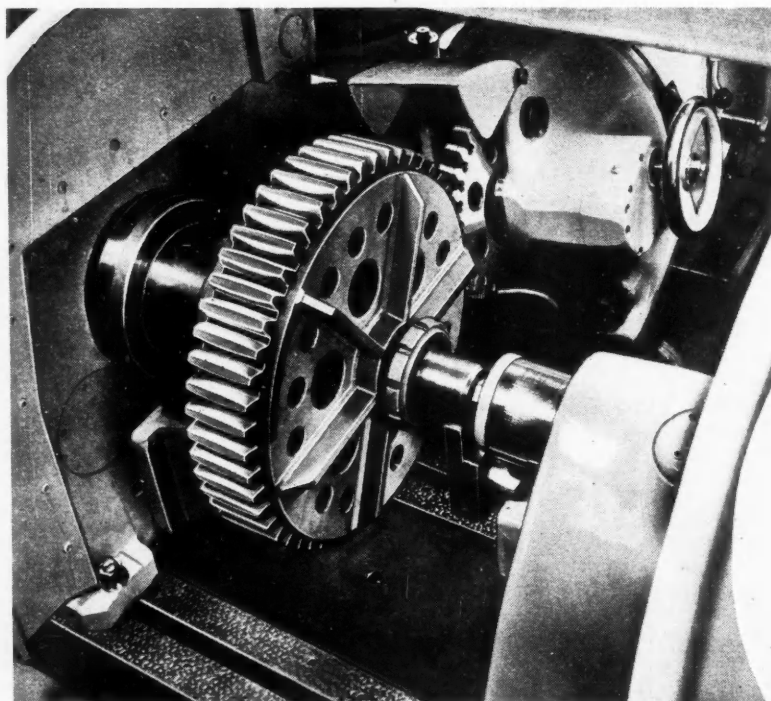


This rear bogie, from which the vehicle derives its name, "Half-Trac," is equipped with endless, rubber belt tracks, which are driven by the forward axle. The lower rollers have solid rubber tires.

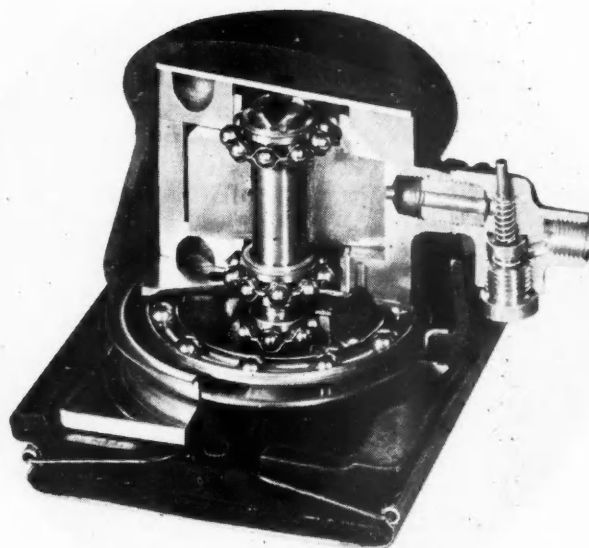
A HANDY maintenance tool is the Air Sander, a high speed non-stalling unit that is being manufactured by the National Air Sander, Inc., Rockford, Ill. It can be used for finish applications on metal, wood, leather, plastic and composition surfaces. With each tool is furnished two interchangeable pads for wet and dry sanding. The sanding pad does not revolve, but moves in a circular path so that each grain of sand scribes a 3/16-in. circle. The quarters cut from the standard abrasive sheet fit the pad. The sander operates at 5000 cycles per min. at 50-60 lb. air pressure. Vibration is held to a minimum by incorporating in it a sturdy crankshaft and oversize ball bearings. An oil-resisting rubber cover completely seals the motor and bearings. (Illustrated on this page.)

A NEW bench center for inspecting a wide variety of work up to 6½ in. diameter by 18 in. long has been announced by Barber-Colman Co., Rockford, Ill. It provides an accurate, fast method for inspecting cylindrical and circular pieces that either are held between centers, or are mounted on arbors, as in the case of a gear or gear blank.

Both headstock and tailstock are adjustable, the latter having a spring-loaded, hardened and ground sliding center which can be readily locked in position. The headstock center is fixed and all three sliding members locate from the same reference surfaces, insuring accuracy. The slide, or indicator base, is provided with a vertical post and is used with a standard type indicator clamp. (Illustrated on this page.)



MEN and



(Above) Cutaway view of National Air Sander

(Upper left) Large elliptoid gear being shaved on the new ring gear shaving machine of National Broach and Machine Co.

(Left) Barber-Colman Bench Center

NATIONAL BROACH & MACHINE CO., Detroit, now makes a 36,000-lb. ring gear shaving machine for gears up to 36 in. diameter, 2 in. pitch and having face widths up to 36 in. The cutting tool of this machine is driven by the work gear to prevent high driving torque. Another important feature is its ability to develop the elliptoid tooth. The amount of crowning is optional and can be varied by a graduated adjustment. The cutter head slide is adjustable for various center distances up to 50 in., and the head accommodates cutting tools of 7, 9 and 12-in. diameters.

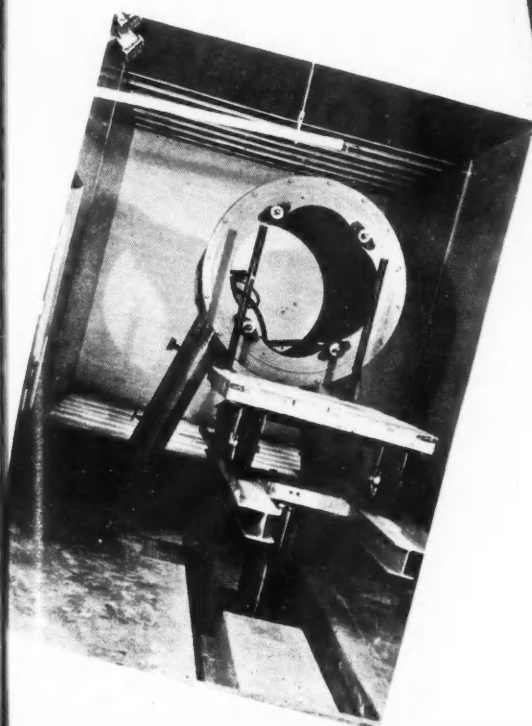
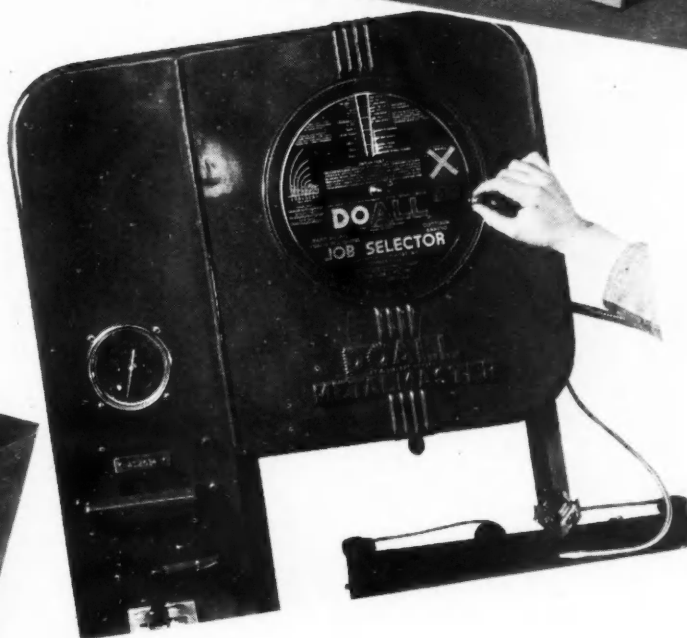
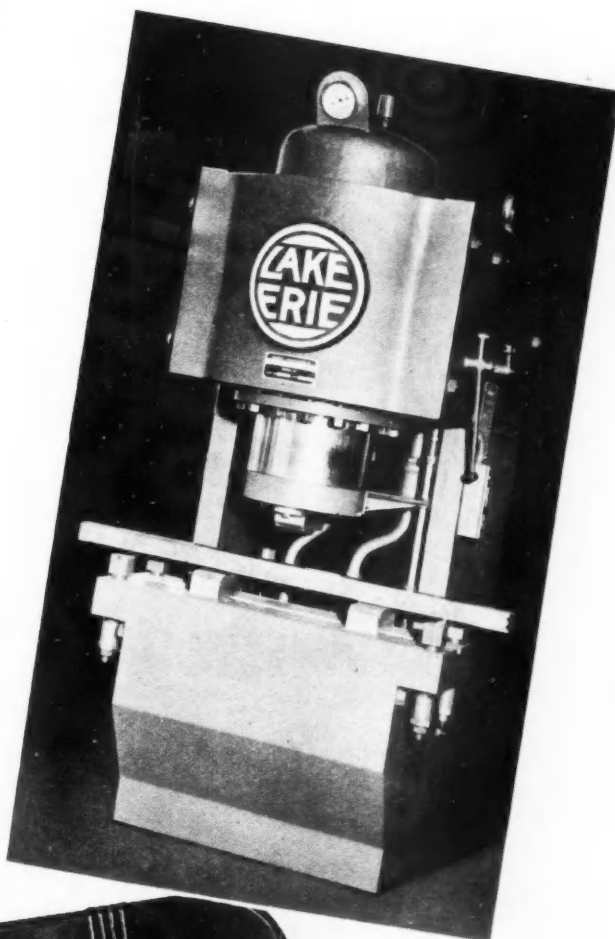
This new machine is entirely automatic and its action is under the control of microflex timing units which are controlled by elements on the electrical panel board in the base. (Illustrated on the facing page.)

MACHINES

(Top) Hydraulic straightening press of Lake Erie Engineering Corp.

(Center right) New Doall Job Selector

(Below) Manley hydraulic lift for hoisting aircraft engines



WITH the increasing demand for speed in production covering thousands of materials, the new Doall Job Selector is a ready reference to all basic materials which are to be contour sawed or filed. Recognizing the great increase in use of alloys, Continental Machines, Inc., Minneapolis, Minn., has incorporated it on all the Doall Contour sawing, filing and polishing machines.

The new Job Selector lists 56 basic materials including ferrous to non-ferrous materials. It shows the correct sawing speed, saw pitch, saw temper, and saw set to get the most economical performance from the Doall machine. The same information is given

(Turn to page 68, please)

New Borg & Beck Fluid Coupling

FOLLOWING a period of experimental production and testing, Borg & Beck Division, Borg-Warner Corp. will be in production shortly on a 12 $\frac{3}{8}$ -in. diameter fluid coupling for several passenger car builders. The unit illustrated here is typical of the construction but may be modified in some respects to suit the requirements of individual users.

In general design, the Borg & Beck fluid coupling follows the pattern of the 13-in. coupling already in use on certain makes of cars. As a matter of fact, some of the parts are even interchangeable, notably the oil seal assembly and the Morganite oil seal ring. However, in the interest of national defense, Borg & Beck has substituted a plain carbon steel spring of larger diameter, lower stress wire in place of the high chromium alloy spring stock used in the larger coupling.

The forward needle bearing is of the same size, but the rear needle bearing is $\frac{1}{8}$ in. smaller in diameter, due to the use of a 1 $\frac{1}{8}$ -in., 10-spline shaft in the transmission. This reduction in diameter makes it possible to assemble the coupling flywheel with a taper and key instead of employing a tapered spline joint.

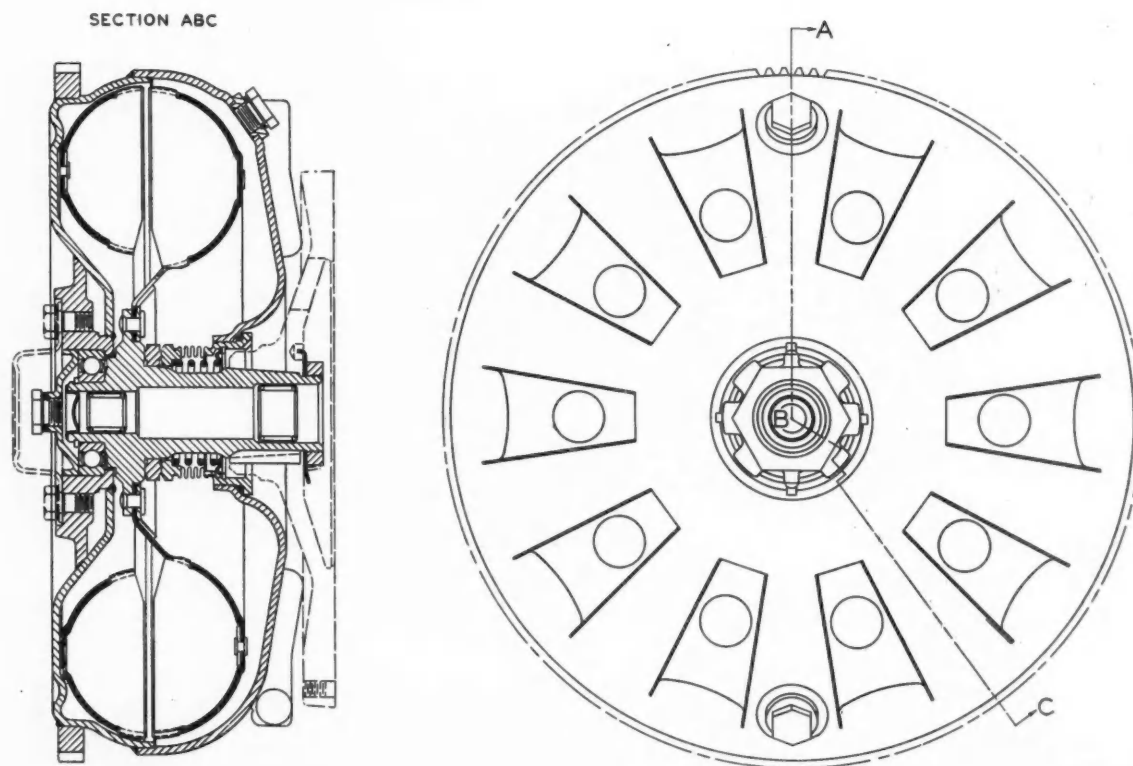
In output the coupling compares favorably with the 13-in. unit on the basis of tests with an engine of 240 pound-foot capacity, using a larger impeller but a runner of the same size. Research indicates that the chief problem in the design of fluid couplings is that of providing adequate ventilation and ample radiation.

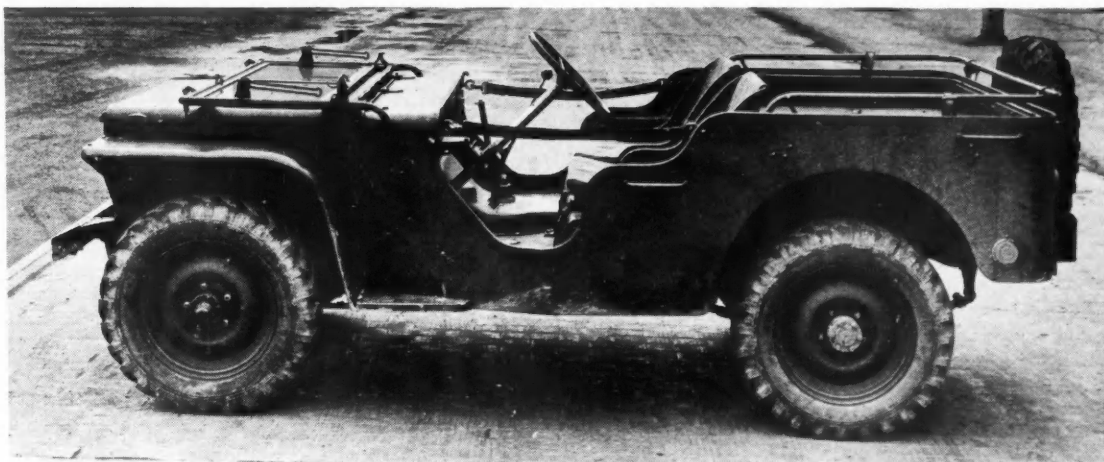
By doubling the number of cooling vanes, and making the vanes (fan blades) of generous size, it is possible to handle an unusual amount of torque with the 12 $\frac{3}{8}$ -in. coupling without encountering excessive temperature rise.

During the development of the Borg & Beck coupling, it was found that certain combinations of blades introduced an objectionable hum at critical slip speeds. This was overcome by using the 24-27 blade combination. Many experiments also were conducted with different torus ring cross-sections. Although the combination of the small section impeller and larger section runner, as illustrated, has been adopted for one passenger car producer, it is quite likely that other applications may require impeller and runner of the same cross-section.

As a further explanation of this, it may be noted that conditions of operation such as the number of engine cylinders, resonance of engine mountings, etc., all have their effect upon the smoothness of coupling operation. Best results for one make of car were achieved with the set-up illustrated here. In this particular car, experiments were conducted with equal sized runners of various cross-section but none seemed to give the same order of all-around results as does the unequal sized set-up, principally because there was less cavitation with the latter combination. It may be noted that cavitation causes non-uniform operation

(Turn to page 66, please)





More About the Ford Blitz-Buggy

THE ¼-ton Command Reconnaissance car built by Ford Motor Co. for the U. S. Army is a unique military vehicle in every respect and has mechanical features of outstanding character. The principal running gear components comprise—the four-cylinder Ford engine, the standard three-speed Model A Ford transmission, a two-speed de-clutching type transfer case, front and rear driving axles of hypoid gear type with Rzeppa constant-velocity universal joints on the front axle.

The Ford Blitz-Buggy, as it has been termed by the press, is an extremely mobile vehicle and has demonstrated its ability to negotiate any kind of terrain, reaching its objective almost as the crow flies. It has a top speed of about 55 mph. on the highway in high gear. In addition to the wobble stick control of the conventional transmission, there are two short control levers in the front compartment which provide the auxiliary functions contributing to the mobility of the car under all manner of road conditions. The first of these levers selects either the high or low speed range of the transfer case, thus providing an extremely low reduction in combination with the main transmission when traversing mud and sand or other unfavorable terrain. The shorter lever permits de-clutching of the transfer case so that the front driving axle may be cut out, driving with only the rear wheels at high speed on the highway.

The vehicle has a wheelbase of 80 in., front and rear tread of 47½ in. Net weight is 2100 lb., gross weight with load of 700 lb., is 2800 lb. Single tire equipment is used, tires being either 5.50 x 16—4-ply or 6.00 x 16—4-ply, with mud and snow tread.

The engine is four-cylinder, L-head, 3.185 in. bore x 3.75 in. stroke, 119.5 cu. in. displacement, rated 42 hp. at 3600 rpm. It is fitted with an oil bath air cleaner and an oil filter. The carburetor is a Holley single

down-draft type with an 0.054 in. metering jet, an 0.030 in. power jet, and 1.031 in. venturi. The clutch is a Long, single-plate, 9 in., semi-centrifugal type. Spark plugs are 14 mm.

The transmission, as noted earlier, is the familiar Ford Model A unit with three forward speeds—3.1215 to 1 in 1st, 1.8567 to 1 in 2nd, and direct in 3rd. Reverse has a ratio of 3.7458 to 1.

The transfer case is mounted to the end of the transmission offsetting the propeller shaft drive 7.698 in. to the left of the center of the vehicle. The propeller shaft brake is mounted on the transfer case center. The declutching mechanism is integral with the transfer case. The transfer case provides two ratios—direct, and 1.97 to 1 underdrive.

Front and rear axle are of hypoid type and of substantially the same mechanical design save for the tie rod and steering gear attachments at the front, also the use of Rzeppa (Gear Grinding Co.) constant velocity joints at the front end. Both axles are full-floating with a reduction of 4.875 to 1.

Front and rear springs are semi-elliptical, mounted longitudinally, with the shackle at the rear eye of the rear spring and the front eye of the front spring. Houde shock absorbers are installed on both the front and rear.

Two-shoe hydraulic brakes are used front and rear with a 1-in. master cylinder; wheel cylinders are 7/8 in. rear, and 1 in. front. Molded asbestos brake lining is employed—1.34 in. wide, 10.219 in. long, 3/16 in. thick.

The frame is of rigid construction with substantial channel side members of high tensile steel, heavy cross-members, and a special reinforcement running from the rear kick-up to the center of the rear cross-member, where it has attached a pintle hook for towing guns.

WHAT THE INDUSTRY IS DOING

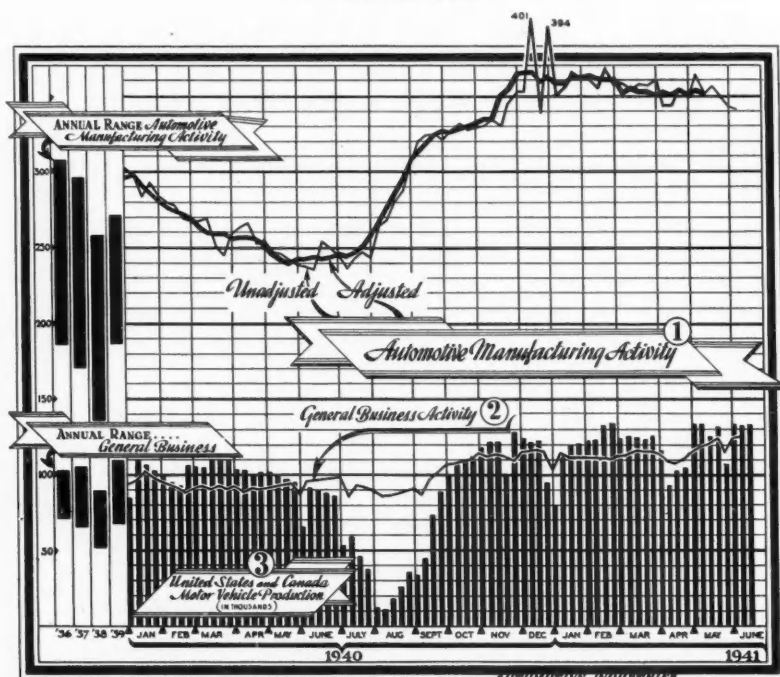
**[Our own view of automotive production and sales;
authoritative interpretation of general conditions]**

PRODUCTION for the first half of 1941 reached approximately 3,162,000 motor cars and trucks, the second highest initial six-month total on record. June's output of an estimated 548,000 vehicles brought the six-month figure second to the 1929 mark of 3,413,804. The June total also was the second highest for that month in the industry history, exceeded only by June, 1929, when output was 567,424 units. The six-month total for 1941 is 25 per cent greater than the corresponding period of 1940, while June production is up 51 per cent.

Beginning August 1 the 20 per cent curtailment program arranged between the OPM and the manufacturers is scheduled to go into effect. Despite requests of the War and the Navy Departments to further curtail 1942 output to expedite deliveries on defense materials, especially steel, no immediate Government decree is anticipated. W. S. Knudsen, director of OPM, said recently that he saw no need for an additional cut at present, as it would put thousands of men out of work before they could be transferred to defense activities and generally would dislocate the industry economically. The amount of material thus released for the defense program would be negligible.

Mr. Knudsen did say that he expected 1942 model production to be cut more than 20 per cent, but this will come about through the operation of priorities upon materials and skilled labor rather than by Government edict. The 20 per cent cut is set up on a six-month basis and company quotas are due for review about November 1. The industry is due to submit an in-

¹ 1923 average = 100; ² Prepared by Administrative and Research Corp. of New York. 1926 = 100; ³ Estimated at the Detroit office of AUTOMOTIVE INDUSTRIES.



Weekly Indexes of Automotive General Business

Six-Month Output is Highest Since 1929

ventory of its critical and strategic materials to the OPM by August 1 and this report may be the basis for further Government action. The OPM plans to set up a number of industry committees, of which the automobile industry will be one, composed of company and labor representatives, to study problems related to defense work.

Rationing of crude rubber is not expected to seriously impair the automobile industry if the cut is no more than the 600,000-ton limit im-

posed by OPM. Although the industry used approximately 79 per cent of the crude rubber consumed last year, mostly in tires, the 20 per cent production cut is expected to help compensate for the rationing. An increase in retreading and possible elimination of white sidewall tires, which consume 2 lb. more rubber per tire, are likely results of the impending shortage.

Retail sales during May set a new all-time record for the second successive month, reaching the high total of 609,481 units, according to the Automobile Manufacturers Association. This was a gain of 58 per cent over May, 1940, while for the first four months of 1941 retail sales advanced only 35 per cent over the previous year. May new passenger car sales of 524,269 units were up 59 per cent and new truck deliveries of 85,212 showed a 55 per cent gain.

Leon Henderson's letter of June 12 to five automobile companies asking them to rescind price raises which they had instituted in recent weeks had the effect of somewhat curtailing retail demand. Buyers were inclined to await developments on the situation, although no immediate response was made by the companies. The recipients of the letter, Chrysler, Ford,

(Turn to page 70, please)

Chemically Coating Metals

To Reduce Wear

A MODIFICATION of the widely-used phosphating process of protecting metals against corrosion has been developed as a means of reducing wear on moving parts. Owing to the present scarcity of certain metals, it is highly important that scratching and scuffing of moving parts during the "break-in" period and resulting excessive wear and need for replacement be prevented as far as possible. The non-metallic and oil-absorptive quality of the phosphate coating affords added protection to the moving parts in new engines during the "break-in" period and in engines in service while being started from cold, by providing an adequate supply of oil where it is most needed at such critical times.

Various methods and materials have been employed to reduce the rate of wear of moving parts. Though opinions differ as to the best means to be employed to this end, all agree that if serious wear is to be avoided, it is necessary to maintain an oil film between moving parts to prevent metal-to-metal contact. Experience has shown that the non-metallic coating produced by Parco Lubrizing greatly reduces the rate of wear of many metallic moving parts. Estimates based on automobile production figures show that during the past two years the following numbers of parts having been treated to increase their wear resistance:

Camshafts	more than 3,000,000
Piston rings (daily)	250,000
Valve tappets	more than 18,000,000
Transmission gear shifter forks	1,000,000
Generator pulleys	300,000
Valve rocker arms	more than 24,000,000
Fan pulleys	500,000
Universal-joint crosses	500,000
Gasoline fuel-pump arms	500,000

Many other parts, such as hypoid ring gears and pinions, clutch parts, propeller-shaft nuts and compressor pistons for refrigerators, also are treated by this process in regular production.

When iron or steel articles, after being properly cleaned, are treated by the Parco Lubrite process, the surface layer of the articles is chemically converted into a non-metallic, oil-absorptive coating consisting

chiefly of iron and manganese phosphates. Since the coating results from the chemical reaction of the phosphoric acid in the solution with the metal in the surface layers of the parts treated, it is chemically combined with the base metal and has greater adherence than could be expected from any coating which depends upon adhesion. The uniformity of the coating and its penetration into the base metal, which result in the ability to take up oil, are believed to be the principal factors in its influence on the rate of wear of moving parts.

Equipment and Method of Operation

The process is carried out as follows: After the parts to be processed have been properly cleaned, they are immersed for a suitable length of time (10 to 20 minutes) in a solution prepared by adding 10 per cent

of Lubrite by volume to water. This is followed by a rinse in water and a dip in water-soluble oil. The cleaning process to which the articles are subjected prior to the chemical treatment has an influence on the texture of the coating and its penetration into the metal. The parts may be suspended in the solution or they may be handled in bas-

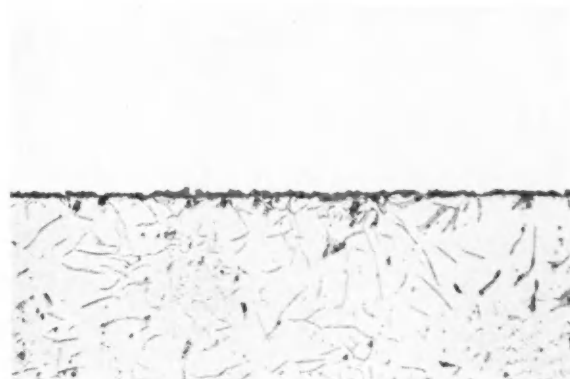
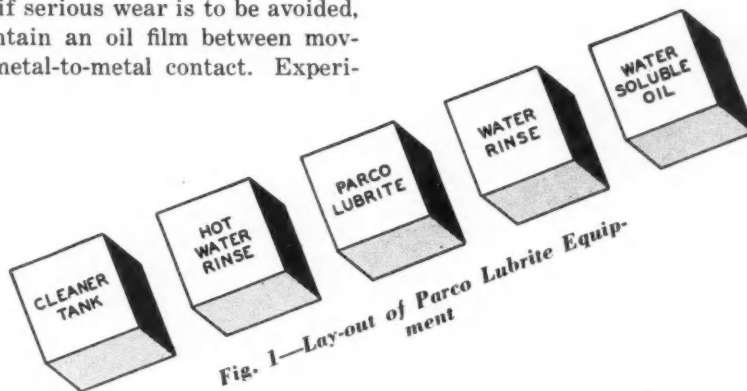


Fig. 2—Cross section of Parco-Lubrite coating on cast iron (unetched)

* Technical Director, Parker Rust Proof Co.

kets, tumbling barrels, or on conveyors. Fig. 1 illustrates an arrangement of the cleaning and processing equipment. Spraying with or immersing in emulsified petroleum-type cleaners and following this up with a hot-water-spray rinse is adequate cleaning, as a rule. In general, the method of cleaning resulting in the maximum wear resistance of the coated articles varies with the material and has to be determined separately by test in each case.

Tanks for the cleaner, rinsing water and soluble oil can be built of ordinary mild steel. The processing tank should be made of some suitable acid-resisting material, and stainless steel and stainless-clad steel have proved entirely satisfactory. The various tanks should be fitted with steam coils to keep the contents at the desired temperatures during operation.

Change in Size of Articles Due to Coating

The crystalline structure and the thickness of the coating, as well as its penetration into the base metal,

are influenced by the method of cleaning the articles prior to Lubrizing. In Table I are given the thicknesses and weights per square foot of Lubrite coatings on steel and cast iron, obtained with different pre-clean methods. The pre-clean methods used are as follows:

1. Vapor degreasing.
2. Vapor degrease, acid pickle, spray emulsion clean.
3. Spray emulsion clean (emulsified petroleum solvent in water).
4. Vapor degrease plus sand tumble.
5. Immersion alkali clean.
6. Oleum spirits wipe.

Table I

Base Metal	Preclean Method	Thickness of Lubrite Coating (in.)	Weight of Coating (Grams per Sq. Ft.)	Lubrite Processing Time
Steel	No. 1	0.0011	2.546	15 mins.
Steel	No. 2	0.00115	2.207	" "
Steel	No. 3	0.00055	2.029	" "
Steel	No. 4	0.0003	1.016	" "
Cast Iron	No. 5	2.85	" "
Cast Iron	No. 3	0.0003	1.33	" "
Cast Iron	No. 1	0.00025	1.13	" "
Cast Iron	No. 6	0.0002	1.11	" "



Fig. 3 — Photographs of Parco-Lubricized pistons after test runs
 Tie-up test
 No run in
 15 minutes at 1000 r.p.m. at wide-open throttle
 2 hours at 4000 r.p.m. at wide-open throttle
 Performance test
 28 hours' run in
 164 hours' run on a cycle of 2750 and 3800 r.p.m.

Fig. 2 is a photomicrograph at 100 magnifications showing a cross-section of the Lubrite coating on cast iron. On such articles as finished cast-iron pistons the increase in diameter usually ranges between 0.0004 and 0.0006 in. Fig. 3 is a reproduction of unretouched photographs of Parco-Lubricized cast-iron pistons run in gasoline engines on dynamometers in "tie-up" and performance tests. The coating is burnished and forms a very smooth surface which has been found to reduce piston wear materially. A substantial proportion of the coating remains on the pistons after such tests.

Figs. 4 and 5 are microphotographs at 10 magnifications showing the original surface of cold-rolled steel and polished cast iron, the Parco-Lubrite coating obtained with different pre-clean methods, and the change in the surfaces due to the treatment. The coating was removed from the specimens by means of an alkaline medium which would not attack the base metal. Vertical lighting was used to photograph the

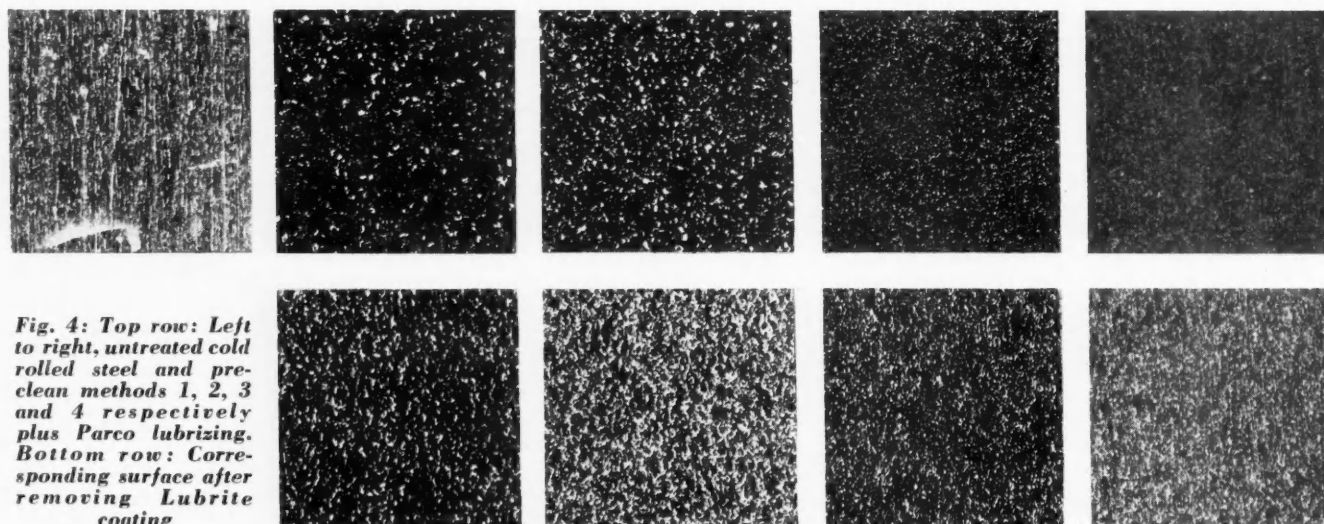


Fig. 4: Top row: Left to right, untreated cold rolled steel and pre-clean methods 1, 2, 3 and 4 respectively plus Parco lubricizing. Bottom row: Corresponding surface after removing Lubrite coating

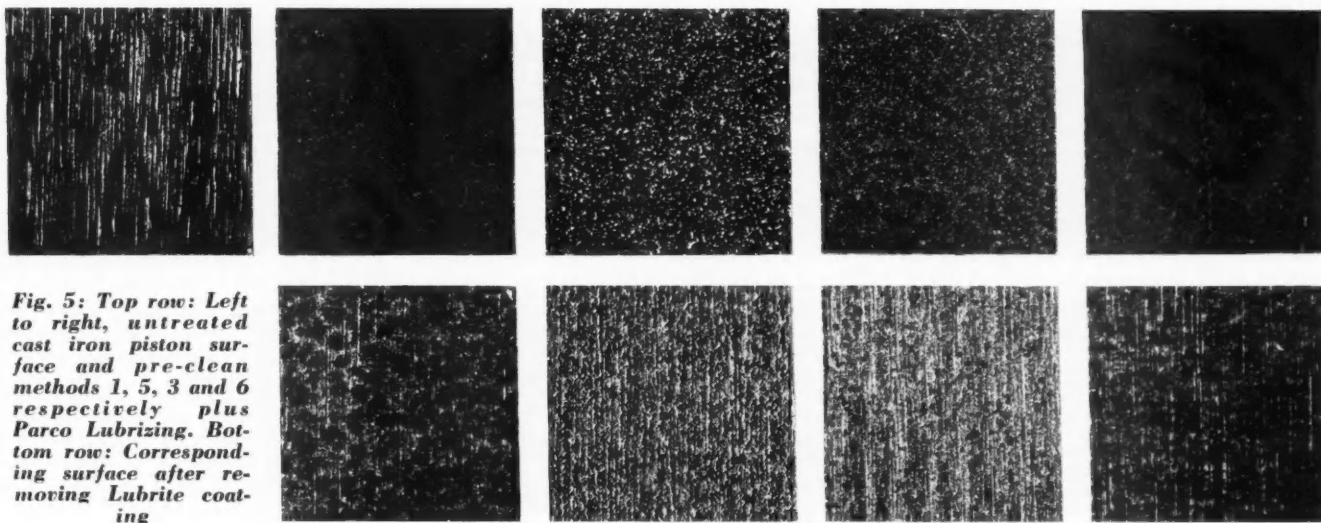


Fig. 5: Top row: Left to right, untreated cast iron piston surface and pre-clean methods 1, 5, 3 and 6 respectively plus Parco Lubrizing. Bottom row: Corresponding surface after removing Lubrite coating

coatings, oblique lighting for the untreated surfaces and surfaces from which the coating had been removed. It is apparent from the photomicrographs that the coarser the crystals of the coating, the more pronounced is the etch and the coating penetration. This holds for both steel and cast-iron articles. It is interesting to note that pre-cleaning by sand tumbling or the oleum spirits wipe produces the smoothest Lubrite coating, and the one with the crystalline structure of finest grain, on both steel and cast-iron surfaces.

Oil Absorption of Coatings

The chart shows the amounts of oil remaining on Lubrized steel specimens when dipped into SAE 10 oil at room temperature and allowed to drain for 10 minutes, and also the amounts of oil remaining on the specimens after blotting the excess off the surface until dry. The film thickness of the oil was obtained by immersing the weighed specimens in the oil, then

removing, allowing to dry, and re-weighing. The increase in weight divided by the density gave the volume of the oil film, from which the film thickness was obtained by dividing by the surface area of the specimen. When oil comes in contact with the Lubrite coating, it immediately wets the surface by diffusion into the coating, and capillary attraction causes it to rise considerably above the level of the contacting oil. The coating acts similar to a wick in an old-fashioned kerosene lamp. This is illustrated in Fig. 6, which shows a steel rod with the Lubrite coating that was placed alongside a ruler in a shallow dish containing oil. After 30 minutes a photograph was taken of the specimen, which showed that the oil had risen $\frac{1}{2}$ in.

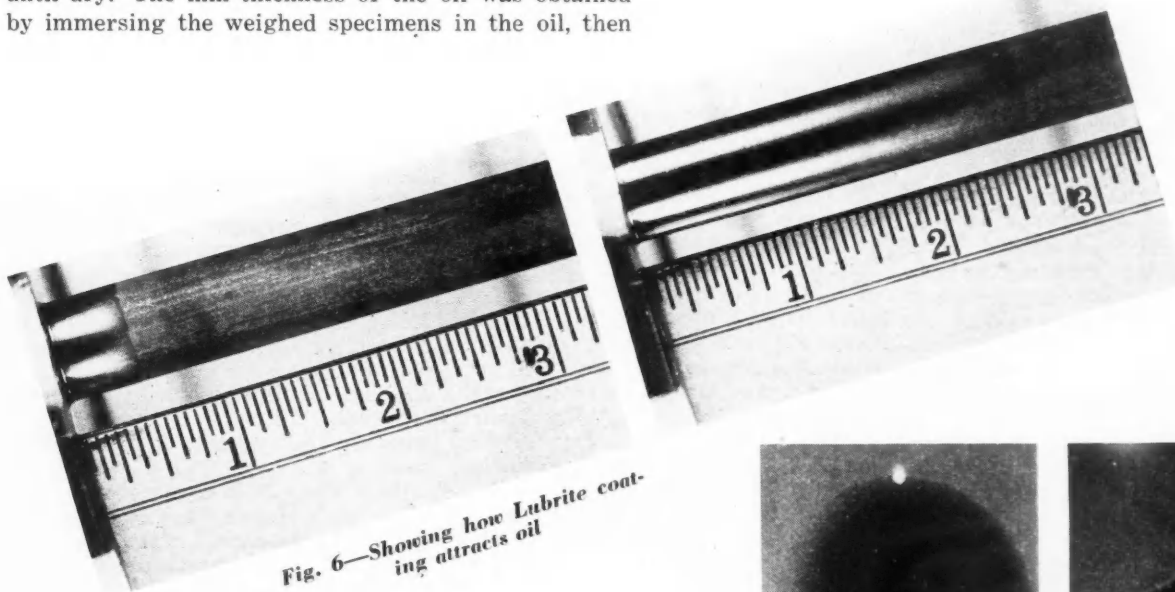
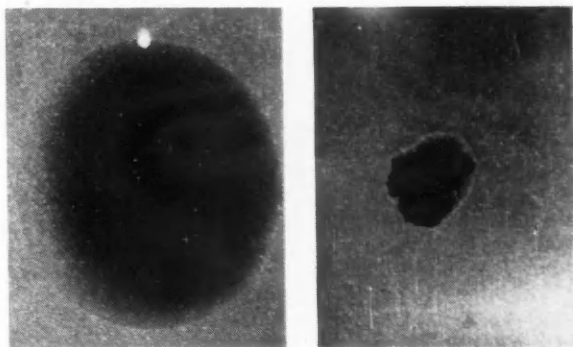


Fig. 6—Showing how Lubrite coating attracts oil

Fig. 7—How a drop of oil spreads on coated steel and on untreated steel



by capillary attraction. After 24 hours it had risen $2\frac{5}{8}$ in. This oil-absorption characteristic of the Lubrite coating causes oil to be taken up and held on the surface of moving parts where it is most needed. This property of the treated surfaces affords added protection of moving parts in new engines during the "break-in" period and in used engines during the cold-starting period, by retaining the oil at such critical times. Fig. 7 shows how a drop of oil spreads on a Parco-Lubritized surface and on untreated steel respectively. The property of causing oil to spread rapidly over coated surfaces helps to provide uniform lubrication for moving parts.

Removal of Scratches from Metal Surfaces

When metal articles are finished by machining, etc., and the finished surfaces are examined under the microscope, they always show scratches. Some of the metal at the surface is loosened and distorted, but still adheres to the surface. Such loosened particles are preferentially attacked by the phosphoric acid in the

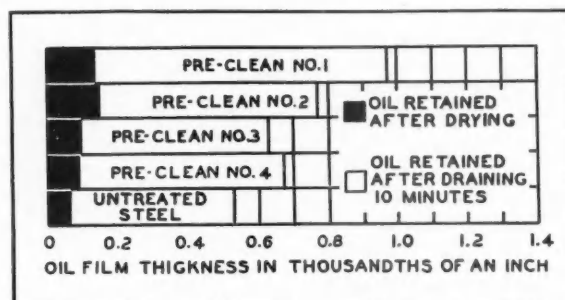


Fig. 8—Oil absorption of Parco Lubrite coating with different pre-clean methods

Parco-Lubrite process, due to their large surface area, and for the most part they are dissolved and removed while the coating is being formed. Fig. 5 shows the surface of a finished cast-iron piston at 10 diameters before and after treatment in Parco-Lubrite. Note how the scratches have been reduced by the treatment. Removal of the distorted metal from the surface of moving parts is believed to reduce wear.

More Motor Companies Gear for Aircraft Parts

EENTRY of Chevrolet into the aircraft engine manufacturing field was assured when William S. Knudsen, director of OPM and one-time general manager of the Chevrolet division of GM, announced that it would build Pratt & Whitney engines. It is understood that the airplane engine project will be centered at Chevrolet's Buffalo plant. Chevrolet will be the third GM division to make airplane engines. Allison Division at Indianapolis is turning out liquid-cooled engines for pursuit planes at a rate of 500 per month, while Buick is constructing a new plant at Melrose Park, Ill., where it will make 1200 hp. Pratt & Whitney engines.

Ford Tackles "Oleo" Problems

Not waiting until its new plant at Ypsilanti, Mich., is completed, Ford Motor Co. has begun the study of manufacturing methods for bomber landing gears in a temporary division of the Rouge tire plant. Simplified production procedure is being worked out for the three-part strut sections. A department is being organized to produce landing gears for five bombers daily.

Aside from the engines, the tricycle landing gear, or "oleo," is the most complicated part of the bomber. Much difficult machining is required because the "oleos" are made of heat-treated, high-tensile steel. The two main struts under the wings weigh 400 lb. each. Tolerances are very close, especially on the cylinder walls of the hydraulic landing gears, which cushion the shock when the 55,000-pound plane descends.

The new Willow Run plant at Ypsilanti should be ready about mid-December, according to President Edsel Ford.

It is expected that airframes for approximately 300 bombers a month will be produced there, and that approximately one-half of these will be assembled into completed B-24 D four-engined bombers. Defense Plant Corp. has added \$46,620,170 to its original allocation of \$10,988,692 for expansion of this Ypsilanti plant.

Some of the Ford-built sub assemblies will be put together in a new Government-financed factory now under construction at Tulsa, Okla., adjacent to the airport. This \$15,000,000 plant, to be operated by Douglas Aircraft Co., Inc., is one of four which will serve as a final assembly center for airframe parts turned out by the automobile industry. The main "blackout" plant will contain 1,280,000 sq. ft. and will measure 320 x 4,000 ft. In addition, there will be an office building, maintenance shop, power plant and paint shop. Employment will total 14,000 to 17,000 workers. Proximity to the airport will permit the bombers to be flown away directly from the factory. Production is expected to get under way early in 1942. The entire bomber production program in which the automobile industry is participating will require \$430,000,000 in machine tools, which will be delivered by July, 1942.

Tank Order More Than Doubled

Chrysler Corp., which will begin mass production in August on an initial order for 1000 28-ton medium tanks at its new Tank Arsenal near Detroit, has been assured an additional order for 1600 more of the steel monsters by the OPM. This order is expected to total

more than \$50,000,000. Chrysler broke ground June 13 on a 125,000 sq. ft. plant in Detroit to manufacture ordnance parts for the 40-m.m. Bofors anti-aircraft gun and aircraft parts for the Martin B-26 bomber. The building will measure 520 x 240 ft.

Campbell Wood, who recently has headed up the national defense work for Nash-Kelvinator Corp. in Washington, has been appointed manager of the new Nash airplane propeller division at Lansing. E. F. Keller, former master mechanic of the Nash Motor Division, will serve as factory manager. He was once master mechanic for Reo, whose former plant Nash will use to manufacture propellers. Other appointments for the new division are B. E. Ball, production manager of the Kelvinator Division, to be production manager; W. R. Crossett, comptroller; B. E. Chapman, plant engineer of the Nash Motor Division at Kenosha, Wis., to be plant engineer; O. E. Summers, employment manager of the Kelvinator Division, to be employment manager, and D. E. Ellis, purchasing agent. Employment will number 2,000 to 3,000 men.

Olds Motor Works plan to build a 187 x 300 ft. structure containing 51,000 sq. ft. for its sheet metal division to supply the automotive division. It will be completed by Oct. 15. Oldsmobile has located subcontractors to supply all but three of the 190 parts that go into the Hispano-Suiza 20-m.m. aircraft cannon which it will make. More than 400 types of machine tools are required for supplying these parts.

Marmon-Herrington Co., Indianapolis, (Turn to page 62, please)

Higher Costs, Less Earnings Big Factors in Price Increases

**Chrysler Explains Refusal to Return to Lower Price Level;
Recent Wage Raises in Industry Estimated at \$100 Millions**

Faced with determined and convincing opposition in his controversy with automobile manufacturers on price control at this time, Price Administrator Leon Henderson has made a "strategic" withdrawal to the 1942 model line with the hint, or to some a threat—"to take the pricing of automobiles out of the hands of the industry." But to do that statutory powers are necessary, the lack of which is believed to have determined Mr. Henderson's course to forego a showdown now and hope to obtain them before the introduction of the 1942 cars.

Recent price increases on some 1941 models stand. Several weeks ago Ford advanced its passenger car prices a flat \$15 on each body model, Chrysler car raises ranged from \$15 to \$53, Dodge \$12 to \$27, DeSoto \$15 to \$47, Plymouth \$20 to \$37, Studebaker \$10 to \$25, and Nash \$10 to \$20. Although no official announcement was made, Hudson is reported to have raised prices \$31 to \$41 per car. Packard announced price increases of \$20 to \$45 per car on the day following Mr. Henderson's decision, having deferred them at his request pending settlement of the issue.

Extraordinary Demands

In an effort to supply civilian needs, at least a substantial part, and at the same time contribute more than its share to the National Defense program, the industry has had to withstand such shocks as strikes in various forms, higher wages due to union demands, increased manufacturing costs, impending production curtailment to uncertain limits, and the latest attempt—price control. If a ceiling is to be established on 1942 model prices, it is believed that they should be worked out at Government-company conferences rather than using 1941 prices as the basis.

Chrysler Corp. brought the issue to a head by declining to rescind its recent price action, and Mr. Henderson immediately charged that the company was refusing "to lend its support to measures of voluntary cooperation." He stated further that "It is the policy of this office to ask companies which are enjoying a good volume of business and profit either directly or indirectly

arising from defense expenditures, to absorb cost increases in a reasonable degree." In reply the Chrysler statement follows in part:

Chrysler's Viewpoint

Mr. Henderson has a very difficult undertaking and we appreciate his problems. To control prices at all successfully in this industry it is necessary, as he suggests, to include manufacturers' prices, dealers' prices and trade-in values. In addition, it is necessary to go back to the costs of labor and material prices, suppliers operations and prices they in turn have to meet. There should be no discrimination as between industries or companies within an industry, nor should there be any favored group.

We think it only fair, however, that in the light of Mr. Henderson's statement, we should make two things clear—first, the fact as to our extensive cooperation with the Government on defense matters and, second, the facts as to the price increases which we were asked to rescind.

In the year ending May 31, 1941, we delivered to the Government \$31,666,171 worth of finished products—trucks and other army vehicles, repair and replacement parts for them, cartridge cases, bomb nose fuses, field kitchens and space heaters. On this entire business we made \$13,295, a profit of one twenty-fifth of one per cent.

Chrysler Corp. has at no time attempted to disregard the work of the Office of Price Administration and Civilian Supply and this present price increase was made without any knowledge of any communications or expressions of the OPACS on the subject of automobile prices.

On June 1 the corporation's payrolls were increased eight per cent and last December they were increased two per cent. Prices on the current models were set last September. We have had two increases in labor and many increases in material, tools, and supplies since then.

The effect of these various payroll and other increases caused an estimated increase in the cost of these cars of \$27.55—equal to 4.89 per cent of the cost of the car.

On June 4 the corporation increased the prices of its domestic passenger cars by 4½ per cent, which added to the corporation's income before taxes \$26.62 per car.

For the last 12 months on which the corporation has figures, namely April 1, 1940 to March 31, 1941, the corporation's net profits after taxes on its domestic passenger car business amounted to \$30.47 per car or 4.41 per cent of the sale price of the car. The \$27.55 increase mentioned above, coming almost entirely since the turn of the year, is significant when compared with the \$30.47 profit.

So far as last year's profits are concerned, to which reference was made by OPACS, it is true that they amounted to \$37,802,000. In considering them, however, it is interesting also to note that during the period in which they were earned, this corporation paid \$53,177,000

in taxes, \$137,000,728 in wages and salaries and \$453,596,000 to other businesses selling us materials for our cars and who in their turn paid wages and taxes. Furthermore, from these earnings \$23,931,000 was paid to the stockholders in dividends, the balance remaining in the business to finance its future growth and operations. Our 55,000 stockholders received about \$440 apiece for the year on the average.

The automobile industry, which is being restricted in its output for civilian use and is being subjected to extraordinary costs in undertaking unusual production for defense, should not be compared with industries which are increasing their production of their usual products. There are also marked differences between an industry making highly fabricated products from diverse materials drawn from all parts of the country and an industry whose products are derived from basic raw materials such as ore, cotton, wool, oil, etc.

We regret earnestly that Mr. Henderson's office thought it necessary from their viewpoint to use our situation as they did, but we hope that this episode, unfortunate as it is to us, helps to bring about sound price policies generally.

This incident will in no way affect our continued effort to cooperate with them and all other Government agencies engaged in promoting National Defense.

"Your industry is completing one of the best, if not the best year in its history," Mr. Henderson said in his recent letter to the presidents of Chrysler, Ford, Hudson, Nash and Studebaker, requesting that they rescind the price advances. He then went on to say, "In view of its favorable earning record no justification could be made for these price increases on grounds of diminished profits."

Earnings of Companies

While no complete financial statement of the Ford Motor Co. is available, from the partial report filed with the State of Massachusetts for 1940 the indicated earnings per share were \$3.01 for 1940 as against \$4.75 for 1939, a decrease of \$1.74. Since 1940, Ford has been faced with a complete shutdown due to strikes, which automatically increases the cost per unit. In addition, along with all the other motor vehicle manufacturers, Ford has had to replace materials, which invariably produce an increase in cost of processing and manufacture. His labor costs are also being increased materially.

Hudson at the end of 1940 showed a deficit of over \$1,500,000. Nash at the end of the fiscal year, Sept. 30, had a deficit of \$1,573,000. Studebaker, while it showed a net income for 1940 of slightly over \$2,000,000, for the first quarter of 1941 the net was only \$180,000 as compared with \$511,503 for the same period of 1940. In the first quarter of 1941 Chrysler's earnings per share dropped to \$2.20 from \$3.62 for the same period of 1940.

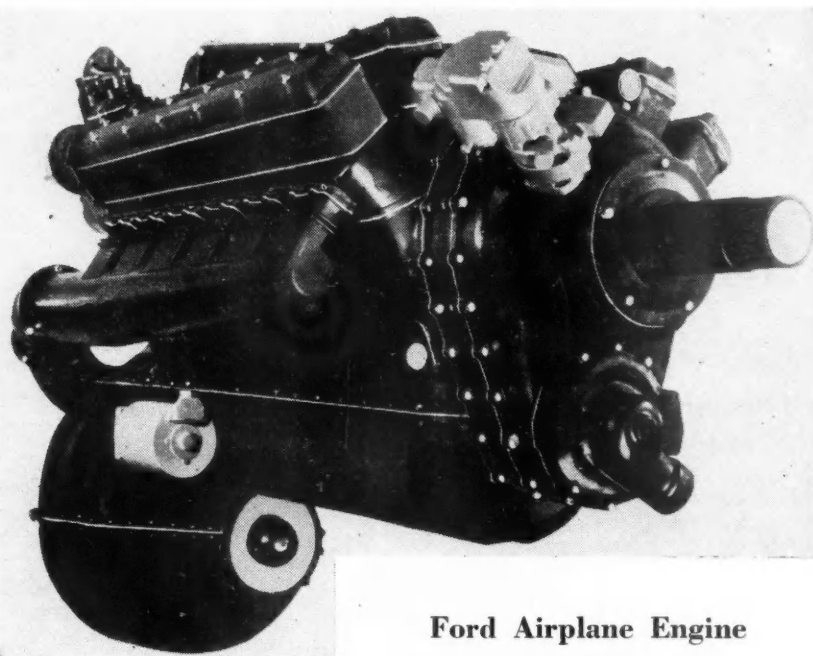
(Turn to page 42, please)

PRICE INCREASES

(Continued from page 41)

All of the recipients of Mr. Henderson's letter show substantially declining profits for the first quarter of 1941 as compared with a year ago. All of these declines in earnings are in the face of substantial increases in volume of business and indicate absorption of much of the manufacturing cost increases. However, it is regarded as doubtful that absorption of material cost and labor increases could be safely continued.

Since the end of the first quarter, labor costs have gone up on an average of about 10 per cent. According to one authority wage raises for the industry amounted to \$100,000,000. One car manufacturer estimates that material costs have increased \$25 per unit; another announces that wage raises and bonuses will cost his company \$19,000,000 over a period of 17 months. The Automobile Manufacturers Association estimates that 85 per cent of the cost of manufacturing a car goes to labor.



Ford Airplane Engine

Wood mock-up shows interesting details of Ford 12-cylinder aircraft engine expected to deliver between 1500 and 1800 hp. even at 32,000 ft. Note position of the exhaust-driven supercharger at lower left.

Forty Groups Exhibit Test Apparatus at ASTM Meeting

Photographic Display Also Attracts Considerable Attention; Over 115 Technical Papers and Committee Reports

With a large attendance of chemists and metallurgists, the American Society for Testing Materials held its 44th annual meeting during the last week of June in Chicago and among the most interesting sidelights was the biennial exhibit of test apparatus and instruments, and the ASTM photographic exhibit touching on the general theme—materials, testing, and research.

The meeting was particularly timely owing to the wide interest in materials for the National Defense, problems of alternate materials, synthetic products, and the need for efficient methods of testing and specifications writing. The exhibit of test apparatus brought together a group of some 40 organizations prominent in the field of instrumentation, stressed some items of wide

interest and novelty. Coleman Electric Co. displayed its new universal spectrophotometer, the grating spectrograph, and the pH glass electrode industrial tester. National Carbon Co. exhibited a new accelerated fading unit designed to provide a standard for comparing the color fastness of dyes, paper, textiles, plastics, etc. The well-known Fade-Ometer and Weather-Ometer were shown by the Atlas Electric Devices Co. Baldwin-Southwark presented a line of plastics impact machines, damping capacity machines and strain gages.

Magnaflux Corp. demonstrated the now familiar Magnaflux inspection technique, using one of the latest machines for the purpose. Instrument Specialties Co., Inc., makers of precision mi-

(Turn to page 62, please)

New Truck Registrations*

	April*	March*	April	FOUR MONTHS		Per Cent Change, 4 Months 1941 over 1940	Per Cent of Total Four Months	
	1941	1941	1940	1941	1940	1940	1941	1940
Chevrolet	22,497	21,053	19,429	75,129	67,969	+ 10.6	33.01	34.67
Ford	16,789	18,662	15,444	67,779	55,811	+ 21.4	23.78	28.47
International	9,129	8,504	7,049	32,070	24,539	+ 30.5	14.08	12.52
Dodge	6,038	5,354	5,654	20,029	19,696	+ 1.7	8.80	10.05
G. M. C.	4,267	3,950	4,071	14,723	13,394	+ 10.0	6.47	6.83
Plymouth	1,041	1,023	1,070	3,677	3,534	+ 5.0	1.62	1.79
White	918	802	840	3,040	2,314	+ 31.6	1.34	1.18
Mack	931	796	656	2,932	2,187	+ 34.0	1.23	1.11
Diamond T.	701	583	563	2,167	2,097	+ 3.5	.95	1.07
Studebaker	475	383	133	1,320	473	+ 179.0	.58	.24
Autocar	250	215	156	793	530	+ 49.5	.35	.27
Divco	217	217	165	733	604	+ 21.2	.32	.31
Brockway	229	175	102	687	434	+ 58.3	.30	.22
Willys-American	186	168	222	518	810	- 36.0	.23	.41
Federal	137	112	152	505	579	- 12.6	.22	.30
Reo	154	138	7	461	28	+ 1548.0	.23	.01
Hudson	94	85	92	307	294	+ 8.0	.13	.14
Sterling	48	33	35	150	112	+ 34.0	.07	.06
F. W. D.	18	37	13	93	102	- 8.9	.04	.05
Bantam	7	5	51	26	193	- 86.5	.01	.10
Miscellaneous	110	118	78	464	401	+ 15.5	.20	.20
Total	64,236	62,413	55,982	227,603	195,061	+ 16.0	100.00	100.00

* In addition to these data there were 5385 Federal Government deliveries during March and 6033 during April, 1941.

CALENDAR

Conventions and Meetings

Natl. Petroleum Assoc. Atlantic City,	Sept. 17-19
Society of Automotive Engineers, National Tractor Meeting, Milwaukee,	Sept. 25-26
Natl. Lubricating Grease Inst. Chicago,	Sept. 29-30
Natl. Safety Council, Chicago,...	Oct. 6-10
Exposition of Power & Mechanical Engineering, Chicago,...	Oct. 6-11
American Welding Society, Philadelphia,	Oct. 19-24
American Society for Metals, Philadelphia,...	Oct. 20-24
Society of Automotive Engineers, Aircraft Production Meeting, Los Angeles,...	Oct. 30-Nov. 1
National Assoc. of Manufacturers, New York City,...	Dec. 3-5

Shows

Automobile Accessories Association Show, Chicago,...	Aug. 4-7
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Automotive Industries

7 REASONS WHY TELEGAGES ARE MORE *Accurate* AND *Durable*

The following are some of the reasons why King-Seeley Telegages have steadily increased in accuracy, reliability and durability:

- ➡ 1 Designed to perform consistently, even though variations in the electrical circuit range from 4 to 9 volts.
- ➡ 2 Built to withstand eight hours of continuous vibration in two planes with the testing machine ranging from 0 to 6000 R.P.M.
- ➡ 3 Oil plug diaphragm metal especially constituted to withstand 10,000,000 stress reversals under loads varying through the full pressure range.
- ➡ 4 Entire assembly built to function over a temperature range of -10° F. to 125° F. with an over-all loss in accuracy of not more than 4%.
- ➡ 5 Adoption of spun glass heater wire insulation as insurance against damage from temporary "shorts".
- ➡ 6 Metal floats chosen in order to maintain initial buoyancy indefinitely.
- ➡ 7 Corrosion-free metal selected for tank arm and bearings to eliminate any tendency to stick.



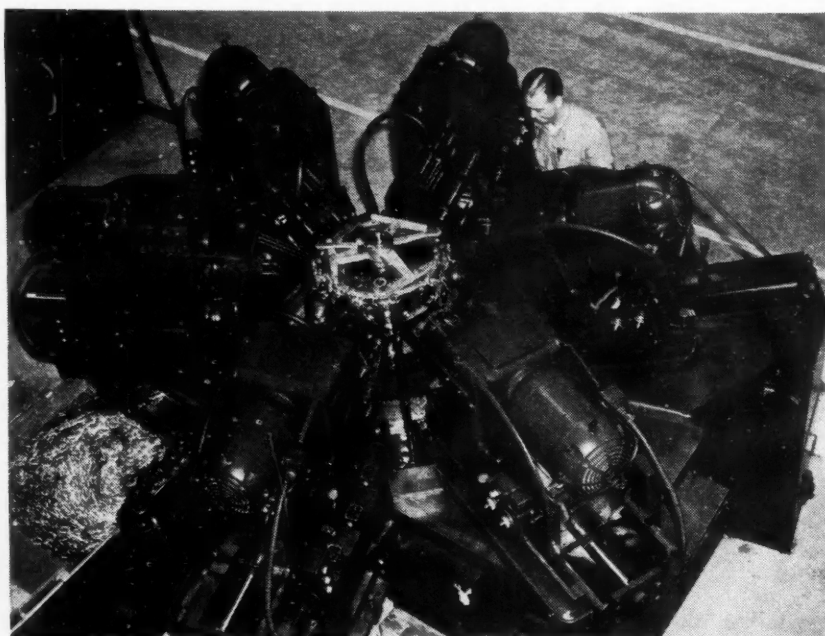
**KING-SEELEY
CORPORATION**

ANN ARBOR MICHIGAN

SUPPLIERS OF ORIGINAL AUTOMOTIVE
EQUIPMENT SINCE 1922

**KING-SEELEY TELEGAGES
SHOW FUEL LEVEL,
OIL PRESSURE AND
WATER TEMPERATURE**
Transmission is entirely by Wire—No Tubes

OTHER PRODUCTS
INSTRUMENT PANELS • SPEEDOMETERS • GOVERNORS



Super Machine for Super Plant

Even in its new 50-acre plant near Cincinnati, Wright Aeronautical Corp. must use super machines to turn out 1000 engines a month. Here is a Greenlee unit which machines a supercharger front at six stations simultaneously.

Most Steel Users Feel Tightening of Supply

Price Levels and Demand for Low-Cost Used Cars Curtails Flow of Scrap; 40% Limit on Use of Raw Nickel

By W. C. Hirsch

Priority holders as well as those whose steel requirements come in for no preference rating are becoming more

and more aware of a progressive tightening in the supply. To priority holders this means for the present nothing more serious than a few days' delay in the receipt of shipments. Manufactur-

ers of non-military products, who are fortunate enough to have reserve stocks of steel have to dig deeper into their stocks, while others, not so favorably situated, are confronted with the problem of curtailing operations until they can get more steel.

Paucity in the supply of pig and scrap iron has begun to make itself acutely felt and many of the smaller non-integrated steel producers are in none too comfortable a position. The movement of scrap iron to steel mills is disappointingly slow. While there may be some instances of wilful withholding of scrap from the mills because of holders' dissatisfaction with the maximum prices now in effect, it is pointed out that there are other factors that make

(Turn to page 60, please)

40 YEARS AGO

Paris-Berlin Race

The tourist section of the automobile race from Paris to Berlin reached Frankfurt-on-Main on the morning of June 25, where each arrival was greeted with a fanfare from a military band. As soon as the automobilists entered German territory they found that every care had been taken by the authorities and by sports enthusiasts for their safety and convenience.

Shouts of "Hurrah!" and "Vive la France" greeted the travelers. Bouquets of roses were rained into the carriages and at Treves, bottles of Mosselle wine garnished with ribbons in French colors were handed to the occupants of each car. Most of the tourists had decorated their vehicles with little German flags.

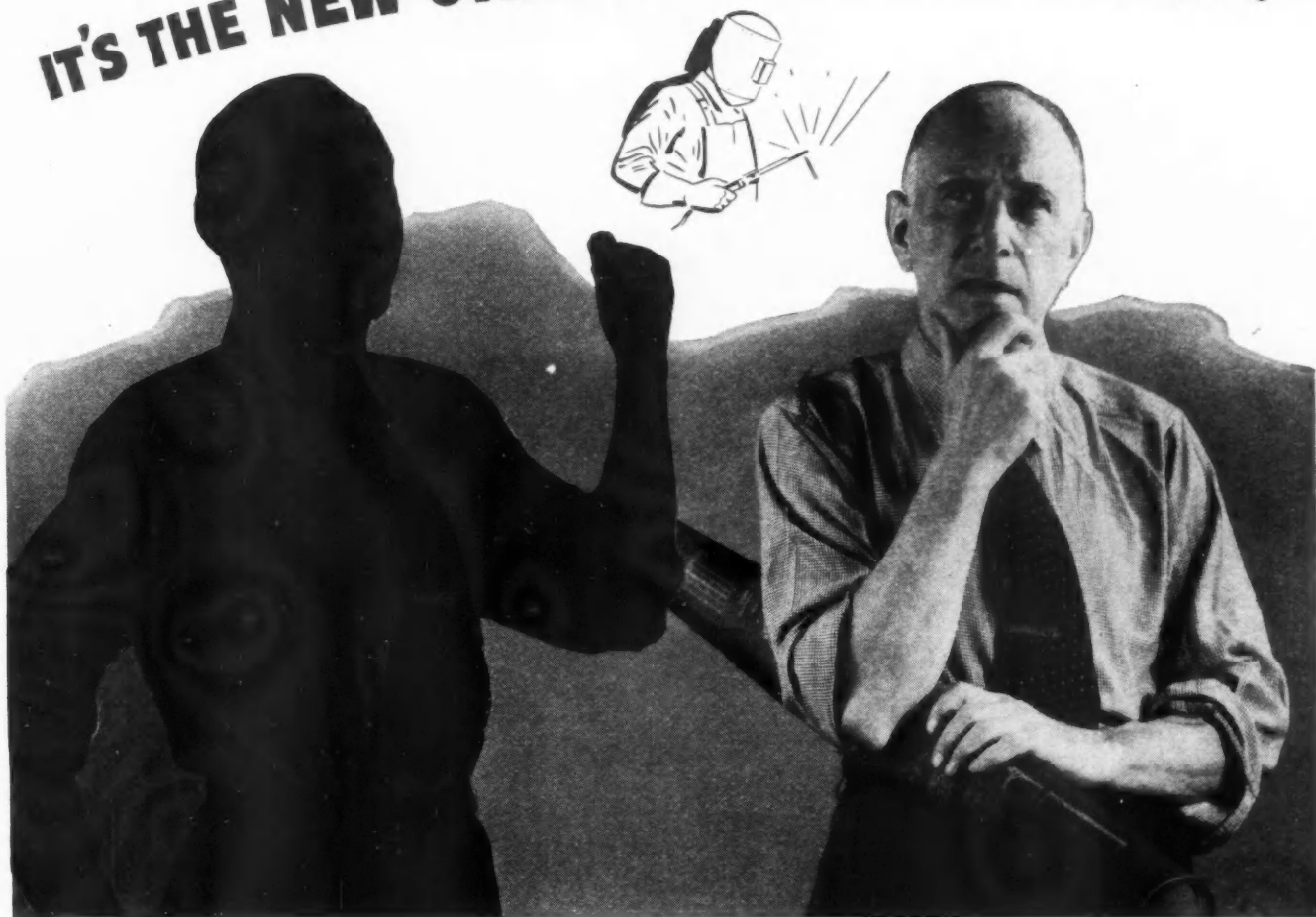
From *The Horseless Age*, July, 1901

New Passenger Car Registrations

	APRIL* 1941	MARCH* 1941	APRIL 1940	FOUR MONTHS		Per Cent Change, 4 Months, 1941 over 1940	Per Cent of Total Four Months		SEVEN MONTHS MODEL YEAR		
				1941	1940		1941	1940	1941	1940	Per Cent Change
Chevrolet	120,879	106,436	89,985	371,742	290,729	+ 28.0	24.70	25.27	604,043	500,295	+ 20.5
Ford	63,009	66,216	56,877	234,102	190,393	+ 23.0	15.55	16.55	378,887	334,764	+ 13.2
Plymouth	63,571	50,599	46,457	183,881	148,050	+ 24.0	12.22	12.87	300,494	222,625	+ 35.1
Buick	44,167	35,216	28,456	130,035	93,172	+ 39.8	8.64	8.09	219,048	171,286	+ 28.0
Pontiac	41,187	34,626	22,907	121,887	73,949	+ 65.0	8.10	6.43	193,462	132,965	+ 45.8
Oldsmobile	33,917	25,838	20,297	98,605	64,851	+ 52.2	6.55	5.64	158,862	118,373	+ 34.2
Dodge	27,985	22,561	21,827	82,370	72,363	+ 14.0	5.47	6.29	126,028	106,502	+ 18.3
Chrysler	19,239	15,522	10,822	55,965	34,346	+ 63.0	3.72	2.99	83,567	50,415	+ 66.0
Studebaker	12,701	10,500	9,878	38,722	32,510	+ 19.0	2.57	2.83	65,640	59,684	+ 10.0
De Soto	11,666	9,060	7,303	32,881	23,864	+ 38.0	2.18	2.07	50,800	35,732	+ 42.2
Nash	10,893	9,446	5,924	32,540	19,136	+ 70.0	2.16	1.66	45,665	33,806	+ 35.0
Mercury	9,133	8,849	8,754	31,866	28,935	+ 10.3	2.12	2.51	51,462	50,953	+ 1.0
Hudson	9,008	7,288	8,004	27,636	26,017	+ 6.0	1.84	2.26	48,030	50,187	- 4.2
Cadillac	7,928	6,253	3,467	24,011	11,698	+105.5	1.60	1.02	37,890	22,964	+ 65.2
Packard	7,723	6,507	7,228	22,806	24,118	- 5.3	1.52	2.10	41,350	45,832	- 9.7
Willys-American	2,319	2,235	2,124	7,539	7,355	+ 2.2	.50	.64	12,385	13,263	- 6.5
Lincoln	2,042	1,840	2,105	7,065	7,502	- 6.0	.47	.65	12,528	13,354	- 6.3
Graham	77	78	114	367	199	+ 84.2	.02	.02	898	512	+ 75.0
Crosley	55	28	51	151	200	- 24.5	.01	.02	262	335	- 21.7
Bantam	18	14	103	75	374	- 80.0	.03	.03	174	606	- 71.3
Miscellaneous	149	284	556	869	690	+ 24.0	.06	.06	2,015	1,297	+ 55.8
Total	488,460	419,396	353,239	1,505,115	1,150,451	+ 31.0	100.00	100.00	2,433,490	1,965,750	+ 23.8
Chrysler Corp.	122,461	97,742	86,409	355,097	278,623	+ 27.5	23.59	24.22	560,889	415,274	+ 35.1
Ford Motors	74,184	76,905	67,736	273,033	226,830	+ 20.5	18.14	19.72	442,877	399,071	+ 11.0
General Motors Corp.	248,078	208,369	165,112	746,280	534,399	+ 39.8	49.58	46.45	1,213,305	945,883	+ 28.3
All Others	43,737	36,380	33,982	130,705	110,599	+ 19.0	8.69	9.61	216,419	205,522	+ 5.5

* In addition to data shown there were 662 Federal Government deliveries during March and 614 during April.

IT'S THE NEW ORDER - OR NO ORDERS!



ALTER EGO: Literally, "one's other self"—the still, small voice that questions, inspires, and corrects our conscious action

What a happy sight the dove of peace will be!

ALTER EGO: Happy only if your sight of that bird isn't obscured by a buzzard searching for the flesh and bones of a shop manager who stopped looking ahead back in hectic '41.

You mean to say I should get more improvement minded?

ALTER EGO: Improvement-minded...and handed...and souled for the oncoming battle for industrial survival. See it coming! Let's not see our business going!

Good hunch. Competition will be stiff. We'd better start developing new de-

signs and get our production in shape.

ALTER EGO: Now, you're thinking in terms of the New Order for future orders!

LINCOLN SUGGESTS: Changeover of your product to welded steel construction, one part at a time, is the NEW ORDER for industrial progress. You can start changing NOW because it needn't interfere with present production demands. Assures product strength, rigidity, light-weight pleasing appearance, and low cost for your future Battle for Profits. "How to Changeover to Welded Design" will guide you. Shows how Lincoln guarantees that you'll profit. Ask for Bulletin 420.

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LINCOLN "SHIELD-ARC" WELDING

THE LINCOLN ELECTRIC COMPANY
Cleveland, Ohio

Authoritative Information on Design • Production • Welding Equipment

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE INDUSTRIES

General business activity during the first half of June was maintained at or near the highest levels ever reached. The seasonally adjusted index of *The New York Times* for the week ended June 14 rose to 130.2 per cent of the estimated normal, an all-time peak, as against 128.0 for the preceding week and 108.6 a year ago. The index of *The Journal of Commerce*, without adjustment for seasonal variation, for the same period advanced to 121.4 per cent of the 1927-29 average from 120.1 a week earlier.

Department store sales during the second week of June, according to the Federal Reserve compilation, exceeded by 13 per cent the corresponding total last year; and for the four weeks ended June 14 the average was 15 per cent above the comparable 1940 figure.

Contracts awarded for heavy construction during the week ended June 19, according to *Engineering News-Record*, totaled \$173,306,000, a 1941 peak, 24 per cent above the preceding weekly amount and 80 per cent above that of a year ago.

The movement of railway freight increased less than seasonally during the week ended June 14. Loadings totaled 862,975 cars, 1.2 per cent more than in the week before and 21.0 per cent more than the comparable number last year.

Electric power production in the same period rose to an all-time peak, 14.7 per cent greater than the output

a year ago, as against a similar gain of 17.1 per cent for the first week of June.

Business failures during the week ended June 12 numbered 230, as compared with 218 in the preceding week and 245 a year ago, according to the Dun & Bradstreet report.

Crude oil production during the week ended June 14 averaged 3,822,750 barrels daily, 6050 barrels more than the average a week earlier, but 7250 barrels below the currently required output as computed by the Bureau of Mines.

Average daily output of bituminous coal during the same period was 1,633,000 tons, as compared with 1,593,000 tons in the preceding week and 1,317,000 tons a year ago.

Cotton mill activity in the second week of June rose against the seasonal tendency. The *New York Times* index advanced to 176.9 per cent of the estimated normal, as against 171.8 a week earlier and 115.7 for the corresponding period last year.

Professor Fisher's index of wholesale commodity prices, continuing an accelerated advance, stands for the week ended June 20 at 94.3 per cent of the 1926 average, as against 92.4 at the end of May and the 1936-41 peak of 94.7 recorded in April, 1937.

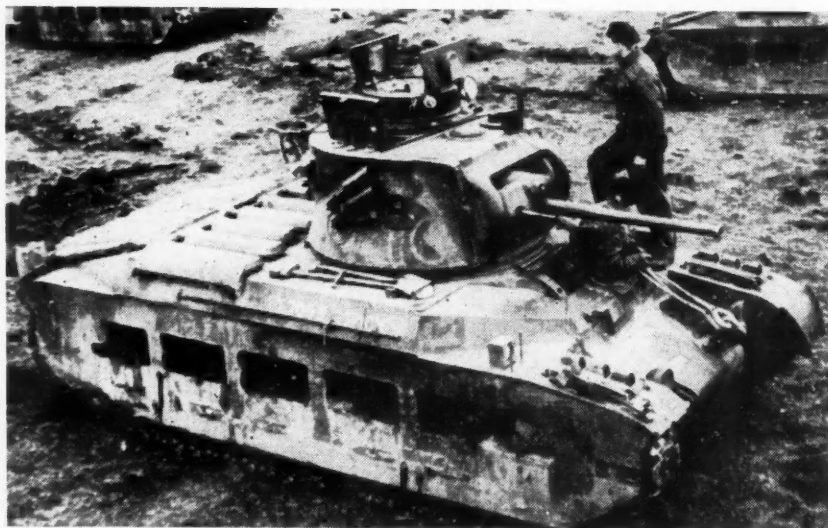
Member bank reserve balances decreased \$181 millions during the week ended June 18, and estimated excess reserves declined \$180 millions to a total of \$5310 millions.

75% Retail Limit Set

Effective July 1, retail establishments will not be exempt under the 40-hour-week, 30-cents-an-hour Wage-Hour law unless at least 75 per cent of their sales are retail. The lifting of the percentage from the previous 50 per cent figure was announced, June 16, by General

Philip B. Fleming, Wage-Hour Administrator, in making public a revision of the Division's Interpretative Bulletin No. 6.

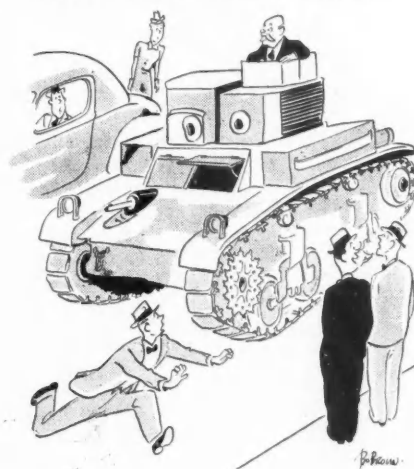
A special section of the booklet is devoted to the status of automobile distributors, including parts and tires, under the new provisions.



Still Waiting for Hitler

This "shot" of a rarely photographed British tank was snapped during maneuvers in Southern England. Well-armed and well-armoured it is expected to carry a heavy share of Britain's defense effort.

The Brass-Hat Rack



"Our contract with the government entitles the boss to the first unit off the assembly line!"

OPACS and OPM Plan Rubber Reduction

A schedule establishing price ceilings on tires, tubes and crude rubber is being issued by the OPACS. It is expected to set net prices on June 16 as the top limit, and the effect of this move is expected to go a long way toward preventing undue hoarding of rubber supplies. Meanwhile the OPM has announced a plan whereby rubber consumption during the last six months of 1941 will be reduced from the current rate of 817,000 tons annually to 600,000 tons.

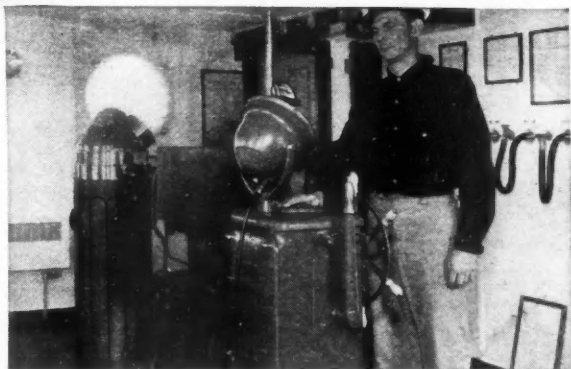
Consumption of crude rubber in the United States during May amounted to 71,187 long tons which was slightly less than the April figure but 30.6 per cent above May a year ago, according to the Rubber Manufacturers Association. The association's estimate on rubber imports for May amounted to 106,159 tons for an increase of 105.9 per cent over May, 1940. Domestic stocks, estimated at 364,107 tons have been pushed 145 per cent above the year-ago figure.

Canadian M-3 Differs from U. S. Tank Design

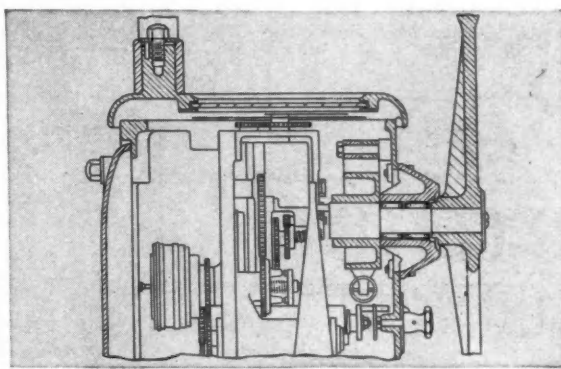
Canada's first pilot model of its 28-ton M-3 tank has been completed at the Montreal Locomotive Works and is to be shipped to this country for tests under the direction of U. S. Army ordnance officers, according to an Ottawa dispatch in the *New York Times*. Its hull, turret and mounting of the 75-mm. gun differ from the American M-3 design. The hull and turret of the Canadian tank are said to be made of a single steel casting each instead of riveted armor plates, with the former welded to the frame in replacing riveted construction. To permit use of its heaviest fire power in any direction, the 75-mm. cannon is mounted on the turret.



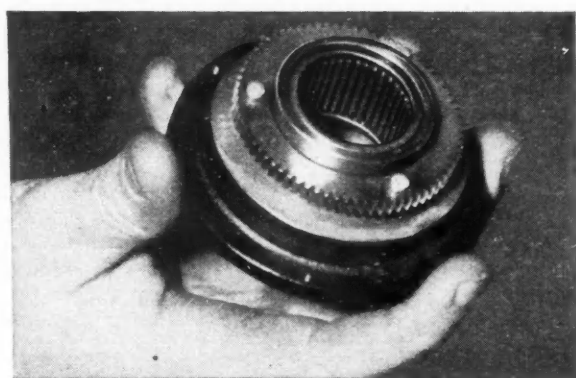
TORRINGTON NEEDLE BEARINGS AID DESIGN AND REDUCE FRICTION FOR SPERRY GYRO-PILOT



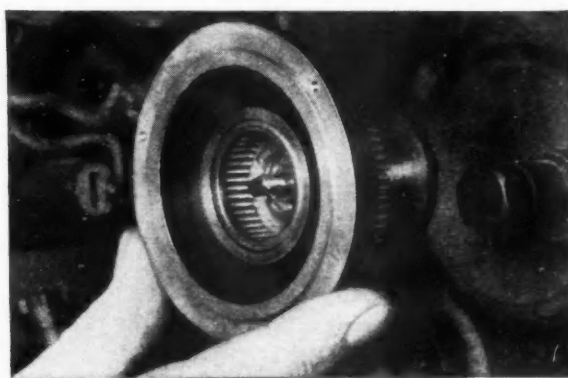
1 The highly precise Sperry Gyro-Pilot and Gyro-Compass are as accepted a part of modern ocean going vessels as Sperry navigation and flight control instruments are in the air. By elevating navigation to a more exact science they have contributed to the safety of thousands of ships the world over.



2 On the steering wheel shaft of the Marine Gyro-Pilot, Torrington Needle Bearings provide a uniformly low coefficient of friction at all positions of the wheel — an important aid in contributing to the smoothness of operation necessary to accurate, dependable rudder control.

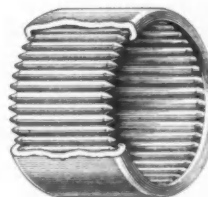


3 Torrington Needle Bearings are also used in the Servo Follow Up Ring Assembly of the Gyro-Pilot. At this point they provide anti-friction performance yet occupy no more space than plain bushings. Their large grease retention capacity practically eliminates further lubrication after installation



4 Being complete units, Needle Bearings save time and cost in assembly and disassembly. And their very small O. D. means excellent economy in size and weight of surrounding parts. These features have also proved highly advantageous in increasing the overall efficiency of many assemblies.

If you seek a bearing with small size, light weight, high radial load capacity, ease of assembly and minimum of lubrication and wear, the Torrington Needle Bearing is probably the answer to your problem. Our Engineering Department will be glad to work with you in adapting its advantages to your product. Write for Catalog No. 107 for detailed information. For Needle Bearings to be used in heavier service, write our associate, Bantam Bearings Corporation, South Bend, Indiana, for Booklet No. 103x.



THE TORRINGTON COMPANY, TORRINGTON, CONN., U. S. A. • ESTABLISHED 1866

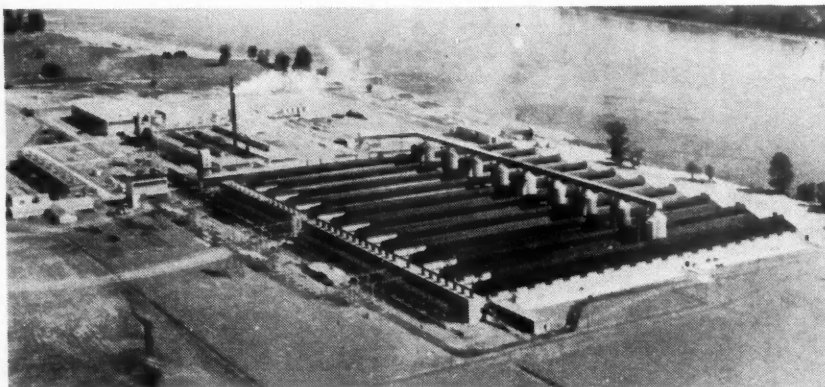
Makers of Needle and Ball Bearings

New York Boston Philadelphia Detroit Cleveland Chicago London, England

TORRINGTON NEEDLE BEARING

Ex Cow-Pasture!

Fifteen months after cows were evacuated from this Columbia River farm Aluminum Co. of America swung into full production at its new Vancouver, Wash., plant where annual capacity is expected to exceed 150,000,000 lb.



The FIRST CUTTING COMPOUND

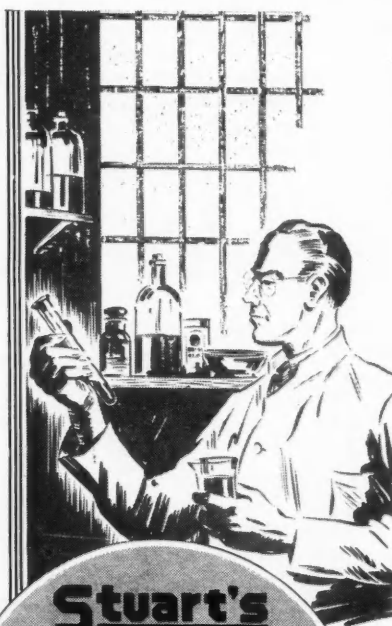
*Developed Especially
for*

CARBIDE and other VERY HIGH SPEED CUTTING TOOLS

THE rapidly increasing use of carbide and other high speed tools emphasizes the immediate importance of this original type of cutting fluid. STUART'S SOLVOL Liquid Cutting Compound was developed especially for this exact condition. Where operations run "too hot" for properly applied straight cutting oils — and where ordinary soluble cutting oils or soluble paste compounds fail to produce satisfactory finish or tool life — that's the place for this original Stuart Oil development.

WIRE TODAY for working sample — FREE to any industrial concern working on defense orders. To assure proper application please tell us name of part, stock, machine and cutting operations.

For All Cutting Fluid Problems
D. A. STUART OIL CO.
Chicago, U.S.A. • LIMITED • Est. 1865
Warehouses in All Principal Metal Working Centers



Stuart's
SOLVOL
AQUAMIX
Liquid Cutting Compound
*Try It Quickly and See
The Difference*



Chrysler Institute Graduates 94

Ninety-four students received degrees, diplomas or certificates from the Chrysler Institute of Engineering at the eighth annual graduation exercises June 12 at Detroit. John Haien, director of Chrysler personnel and defense training activities, delivered the commencement address.

Gold Cup Race Off

The annual Gold Cup speedboat race will not be held this year because the boat owners and mechanics are too busily engaged with national defense activities to allow them time to prepare for the event. The "Hotsy Totsy," owned by Sidney B. Allen, of the Montauk Yacht Club, won the 1940 race in Long Island Sound but that boat has been scrapped and her engines sold. A proposal to transfer the race to the Detroit River at the suggestion of Horace E. Dodge, Jr., has been abandoned.

Dardelet to Detroit

Dardelet Threadlock Corp., formerly of New York, has moved its operating office to the Machinery Building, 2832 East Grand Boulevard, Detroit. Edwin B. Jackson, well-known automotive executive has been made president, and E. R. Evans has been retained as consulting engineer. The Dardelet locking thread has application on rivet bolts, track bolts, set screws, etc.

Leon R. German

Leon R. German, a former executive with Oldsmobile and Peerless, and at one time sales manager of Durant Motors, Inc., died June 13 at his home in Lansing after a long illness.

ADVERTISING

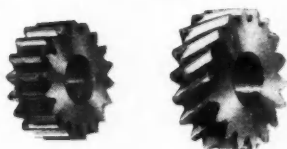
M. R. Crossman heads a new industrial advertising division set up by The Cramer-Krasselt Co., Milwaukee advertising agency. The division will be staffed by men trained in technical writing.

George G. Collins, formerly in the advertising business in Detroit and New York, has joined the staff of Ross Roy, Inc., Detroit advertising agency.

CROSSED AXES GEAR FINISHING

Proves its Value in **DEFENSE WORK**

Crossed axes shaving with a rotary cutter gives the ultimate in speed, accuracy and economy for the correction of index, helical angle, eccentricity and tooth profile of green gears—spur or helical, internal or external. This type of shaving also leaves the surfaces of the teeth smooth and free of compression strains which are unavoidably set up by other gear cutting methods.



Red Ring Shaving is fast because high cutter speeds with rapid stock removal can be utilized—in many cases up to 400 surface feet per minute.

Shaving is accurate, it is entirely independent of the accumulated error of gear trains, indexing mechanisms and numerous other mechanical elements.

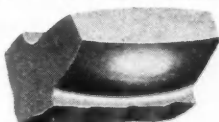


It removes compression strains by removing the strained surface metal in very fine hair-like chips under very little contact pressure. It is in no sense a burnishing operation.

Red Ring Shaving is economical not only because machine time is less but also because tool costs and tool maintenance are considerably less than with other methods.

Red Ring Shaving offers another important advantage. At no extra time or expense gear teeth, while being shaved, can be given the ELLIPTOID form which increases their effectiveness, decreases gear noise and materially increases gear service life.

Write for descriptive bulletin.



NATIONAL BROACH AND MACHINE CO.

5600 ST. JEAN

DETROIT, MICHIGAN

Scope of Ford Contract Is Surprise to Industry

Closed Shop and Checkoff Agreement with UAW-CIO May Set Pattern for Other Firms When Contracts Expire

Granting of the closed union shop and the checkoff to the UAW-CIO by the Ford Motor Co. came as a great surprise to the industry and has made labor history. Besides marking an about face for the company, which has fought unionism for 39 years, the con-

tract also provides the first closed shop and checkoff agreement made by any large manufacturer.

The new contract is not expected to have any immediate effect upon other automobile manufacturers, but it undoubtedly will play an important part

when time comes for renewal of the present contracts. Union officials have indicated that they will demand similar terms when current agreements expire.

As is well known the outcome of prolonged General Motors negotiations, that finally went to Washington for settlement, granted a 10-cent-an-hour, but denied the union shop. On this subject, C. E. Wilson, GM president, gave the company's attitude during the negotiations when he said that if the CIO wanted a closed shop it should seek Federal legislation requiring the closed shop in all industry.

Following the General Motors settlement most of the other large companies granted similar raises under union pressure. In many cases these contract revisions postponed the expiration dates for one year. UAW-CIO contracts with Chrysler expire Nov. 1, 1942; with Hudson, Nov. 29, 1941; with Briggs, Dec. 7, 1942, and with Packard, Sept. 30, 1942. Thus all except the Hudson and GM contracts have at least 15 months to run, although some of the contracts contain provisions for amending the contract on 30 days' notice. The UAW-CIO claims the Hudson contract, negotiated last December, provides for a union shop, but it does not require new employees to join the union nor any punishment for non-payment of dues, although union members are urged to remain in good standing.

Ford-CIO Terms Affect 130,000

Under the terms of the new Ford contract, which runs until June 20, 1942, with a 30-day notice required thereafter for amendment, the UAW-CIO is recognized as the exclusive collective bargaining agent for all production and assembly plants in the U. S. There are about 40 such plants employing approximately 130,000 workers, but NLRB elections were held only at the Rouge and Lincoln plants, where the vote was 70 and 73 per cent, respectively, for the UAW-CIO.

Present employees are given until July 20 to join the union as a condition of employment. All new employees must join. Dues of \$1 monthly will be deducted from each worker's pay and forwarded by the company to the union, assuring the latter of monthly income of approximately \$130,000.

Manufacturing methods and schedules are to be the sole responsibility of the company. There will be one departmental committeeman (shop steward) for each 550 workers or less in a department, making a total of about 1000 at the Rouge plant. Seniority shall be recognized in layoffs or rehiring. In a time of decreased production, employees without seniority (6 months) will be laid off first and then the work week will be cut from 40 to 32 hours before any further layoffs. Employees transferred to the aircraft building or other defense work shall have the right to retain their seniority.

(Turn to page 58, please)

Men at Work

in the private offices and in all corners of automotive industrial manufacturing plants, influence the buying of materials, tools, machinery and equipment.

In addition to the buyers whom your own salesmen contact, AUTOMOTIVE INDUSTRIES reaches men whose names you'll never know—but whose recommendations may mean millions to you.

Also Automotive Industries helps to create and maintain the good reputation of your product in quarters where that help will do the most good.

Automotive Industries

A Chilton Publication

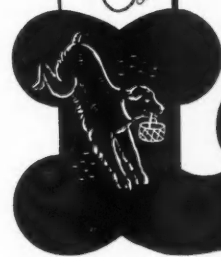


Chestnut & 56th Streets

Philadelphia, Pa.

THE AIREDALE

"The one-man dog," in compliment to his loyalty. Too, the possessor of alert courage that makes him an excellent watch dog.



Loyal!

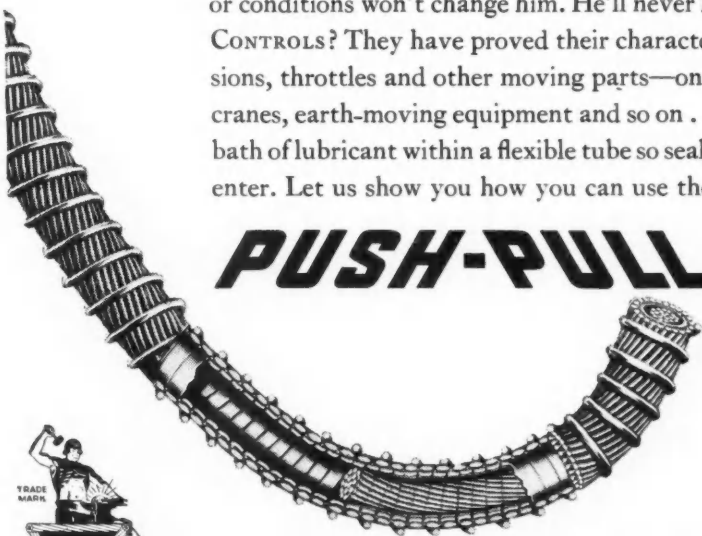
That high point of character soon wins your Airedale an honored place with the family. Years, places or conditions won't change him. He'll never let you down . . . May we say, "*Me, too*" for PUSH-PULL CONTROLS? They have proved their character by their instant operator-control of brakes, transmissions, throttles and other moving parts—on motor cars, trucks, tractors, industrial trucks, shovels, cranes, earth-moving equipment and so on . . . The *principle* is simple—a control unit operating in a bath of lubricant within a flexible tube so sealed that lubricant can not get out nor can grit or moisture enter. Let us show you how you can use the ability of PUSH-PULL CONTROLS on your production.

PUSH-PULL

AUTOMOTIVE CONTROLS

AMERICAN CABLE DIVISION

6-235 General Motors Building, Detroit, Michigan
630 Third Street, San Francisco, California



AMERICAN CHAIN & CABLE COMPANY, Inc.

Motor Men Receive Honorary Degrees

Charles E. Wilson, president of General Motors Corp.; Henry T. Ewald, president of Campbell-Ewald Co., Detroit advertising agency, and James F. Dewey, federal labor conciliator who has been active in settling many automotive disputes, all were awarded Doctor of Laws degrees by Wayne University at the commencement exercises June 12 at Detroit.

Harry C. Mougey, technical director of the General Motors Research Laboratories, received the Lamme Medal "for meritorious achievement in engi-

neering" at the commencement exercises of Ohio State University June 16. He is a graduate of Ohio State.

John D. Biggers, president of Libbey-Owens-Ford Glass Co. and director of production for the OPM, was awarded the honorary degree of Doctor of Laws June 16 at University of Toledo's commencement exercises.

Comfort A. Adams, consulting engineer of the Edward G. Budd Manufacturing Co., Philadelphia, Pa., has been awarded the 1940 Lamme Medal by the American Institute of Electrical Engineers, for his contributions to the theory and design of alternating-current machinery and his work in the field of electric welding. The medal was

presented to Mr. Adams at the annual meeting of the Institution in Toronto, June 16-20.

H. G. Stoddard, president of Wyman-Gordon Co., Worcester, Mass., was awarded the degree of Doctor of Engineering by Worcester Polytechnic Institute on June 13.

The degree of Doctor of Engineering was conferred upon Ralph S. Damon, president of Republic Aviation Corp. by Clarkson College of Technology at Potsdam, N. Y., June 4.

Frederick C. Kroeger, vice-president of General Motors Corp. and general manager of the Allison Division, was awarded the honorary degree of Doctor of Engineering by Purdue University at the commencement exercises June 8 in Lafayette, Ind.

Guy W. Vaughan, president of the Curtiss-Wright Corp., was awarded the honorary degree of Doctor of Engineering June 9 by Stevens Institute, Hoboken, N. J.

Dudley B. Bullard

Dudley Brewster Bullard, vice-president of the Bullard Co., Bridgeport, Conn., died June 10 after a long illness. He was the oldest of five brothers who managed the business founded by their father.

**FOR
BLACKENING
STEEL PARTS**

**HOUGHTO-
BLACK**

- RAPID
- DURABLE
- PROTECTIVE
- ECONOMICAL

HOUGHTO-BLACK is a balanced, uniform blackening solution which is used to give steel parts an even, lustrous black color, resisting oxidation and improving appearance. It is a single-bath treatment which shortens the time materially.

Already it is being used as a finish for machine guns and small arms parts, because it is more rapid, uniform and operates at lower temperatures than processes formerly employed.

It will pay you to investigate HOUGHTO-BLACK. Ask the Houghton Man, or write for factual folder.

E. F. HOUGHTON & CO.

Chicago

PHILADELPHIA

Detroit

HOUGHTO-BLACK

BOOKS

SCIENTIFIC PRICE MANAGEMENT, I. by Allen W. Rucker. Published by Eddy-Rucker-Nickels Co., Cambridge, Mass.

This new handbook was prepared for those who have to make pricing decisions, as executives, sales managers, retail store buyers, merchandise managers, auditors, and trade association officials. It presents a realistic approach to the everyday price problems.

The case studies range from simple price-cuts to problems involving advertising allowances, freight allowances and sales bonuses; in addition, problems embracing added production required of factory employees to justify step-up differential piece-rates.

Six calculator charts, printed in two colors on index bristol board, are incorporated in the manual. To find, for example, the added volume needed to offset a 5 per cent advertising allowance, or to offset bonuses, one simply looks up the answer increased social security taxes or sales on the proper calculator chart.

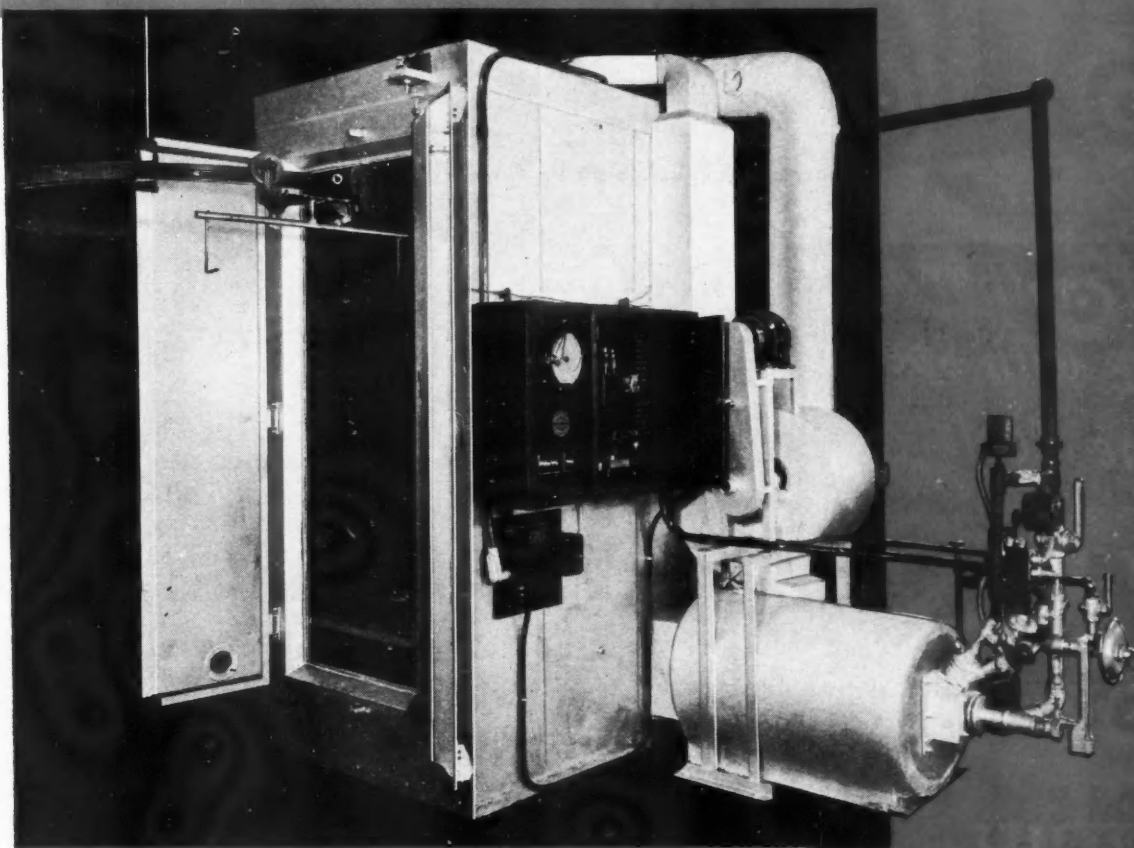
LESSONS IN ARC WELDING, published by Lincoln Electric Co., Cleveland, Ohio.

This book contains a series of 60 lessons which present, in concise manner, fundamental facts of welding, knowledge of which will enable the welder to utilize the process successfully and economically.

Helpful to beginners learning to arc weld, also to experienced welders desiring its comprehensive practical information, and to welding officials, such as supervisors, foremen and instructors, as well as others interested in the subject, the book comprises a ready reference on arc welding and a guide to its proper application. It will be found invaluable, at this time, to any industrial organization faced with the necessity of training its own welders to meet demands imposed by the National Defense program.

A valuable feature is the set of questions and answers for each lesson.

OVENS



MAHON BOX OVENS To Fit Every Industrial Need

In addition to designing and constructing conveyor type ovens for large installations where progressive production is extensive, MAHON also offers a wide range of box type ovens, used for paint drying, core baking, steel drawing, etc., within the temperature range of up to 850° F. These ovens are sub-assembled at our factory for easy installation in your plant. Sizes are optional. Equipment, such as overhead trolleys, shelves, etc., can be fitted to your individual needs. Heating media may be arranged for gas or oil—direct or indirect—or for electricity or steam, if desired. Control apparatus meets rigid requirements of insurance underwriters. Inquiries will receive prompt attention.

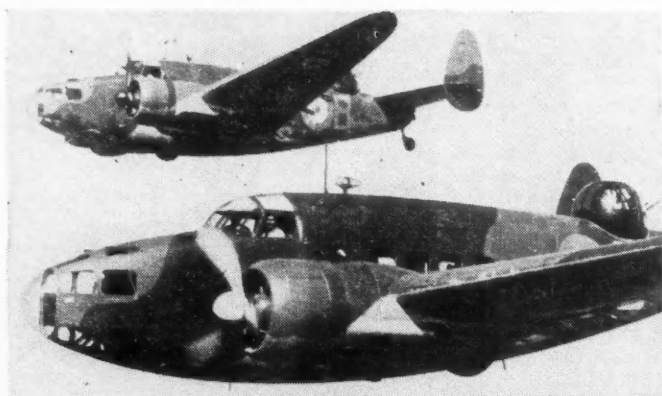
THE R. C. MAHON COMPANY
DETROIT — CHICAGO

Designers and Manufacturers of Complete Finishing Systems, Metal Cleaning Machines, Rust Proofing Machines, Hydro-Filter Spray Booths, Ovens of All Types, Filtered Air Supply Units, Hydro-Foam Dust Collectors and many other Units of Special Production Equipment.

For Use in NATIONAL DEFENSE Production

Box Type Ovens are essential to the manufacture of many items of National Defense production. MAHON engineers will gladly confer with you on this important requirement.

MAHON



Acme

Pacific Patrol

American-built Lockheed Hudson Bombers of Royal Australian Air Force head for advance bases in search of enemy surface raiders.

MEN

Lewis W. Martin has been appointed vice-president and general sales manager of United Motor Service Division of General Motors Corp., succeeding W. N. Potter, who was recently named president and general manager. Martin formerly was assistant general sales manager in charge of the eastern division.

Vernon R. Drum, former operating manager, has been named vice-president in charge of manufacturing for Willys-Overland Motors, Inc. Lester F. Lowry, assistant-treasurer, has been elevated to the post of treasurer.

James E. DeLong, president of the Waukesha Motor Co., Waukesha, Wis., has been appointed assistant chief of the Chicago Ordnance District by the War Department.

Stanley A. McCaskey has been elected assistant-secretary of the Allegheny Ludlum Steel Corp., Pittsburgh; Howard M. Givens, Jr., has been made manager of tool steel sales, succeeding A. F. Dohn, retired. W. E. Griffiths, assisted by W. F. Detwiler, Jr., heads a new development engineering department.

Leslie S. Gillette, an executive of Chicago Pneumatic Tool Co., was reelected president of the New York Sales Managers' Club.

Allison Miller, former Philadelphia regional manager, is now assistant sales manager, Truck Division, Dodge Brothers Corp.

Dr. Campbell Rogers McCullough has been transferred from the research staff of the Phosphate division of Monsanto Chemical Co. to the company's central research department.

Chicago Pneumatic Tool Co. announces the appointment of Myron Powers as manager of purchases with headquarters at the general offices in New York.

Announcement of the appointment of M. S. Brooks, as assistant to K. B. Elliott, vice-president in charge of sales, has been made by The Studebaker Corp.

C. W. Pearsall has been appointed general sales manager of Ahlberg Bearing Co., Chicago.

C. M. Maratta, maintenance engineer for The Timken Roller Bearing Co., has been appointed chief works engineer. Harry McCool, Jr., is now Southwestern sales representative, Steel and Tube Division.

W. R. Walker and H. E. Seanor have been elected vice-presidents of Mack-International Motor Truck Corp. Mr. Walker is liaison man between Mack and the various government departments, Mr. Seanor is in charge of the company's public works contracts.

Appointment of Harold F. Griffin as general sales and advertising manager of The K-D Lamp Co., Cincinnati, has been announced recently.

G. Sherwood Brown, a member of the field organization since 1933, has been appointed assistant advertising manager of Oldsmobile.

U. S. Rubber Co. has announced the following appointments in its tire division: Arnold F. Van Pelt, assistant general manager; F. S. Carpenter, production manager; Howard N. Hawkes, general sales manager; Irving H. Johnson, general control manager, and Harmon F. Newell, sales and production co-ordination manager.

Lawrence C. Ames has resigned as a director of the Lockheed Aircraft Corp., due to his duties at the U. S. Army Industrial College in Washington.

Peter Fassler

Peter Fassler, for many years a welding engineer and executive for Fisher Body, and well known in resistance welding circles of the industry, is reported to have died in Zurich, Switzerland, on May 25. He was 63.

Here's another way to SAVE with Special Machine Tools



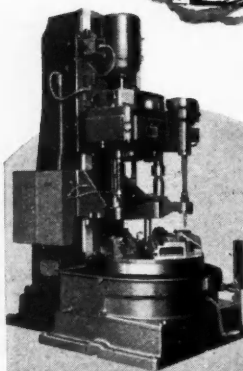
Machining odd lots of odd parts with odd operations is possible and profitable with special machine tools



OIL drilling equipment manufacturing is a far cry from automobile manufacturing. Yet, even for this industry, special machine tools can be designed and built for extremely profitable machining of many different parts which are put through in small lot sizes.

In this case, oil drilling parts, which were formerly machined at the rate of eight parts per day, are now machined at the rate of eight parts per HOUR . . . a savings of eight to one. And, the operations handled on this one machine include drilling, facing, hollow milling, and tapping. Nineteen different parts are accommodated with only five sets of fixtures.

No matter what your product, if your manufacturing includes operations such as those listed below, you may find it more profitable to use our special machine design service. Write for our booklet "Since 1872 . . ." and see how it has worked for others.



W. F. AND JOHN BARNES

ROCKFORD ILLINOIS
DESIGNERS AND BUILDERS OF DRILLING, BORING, TAPPING, MILLING, AND HONING MACHINES TO SUIT YOUR PARTS - YOUR PRODUCTION.

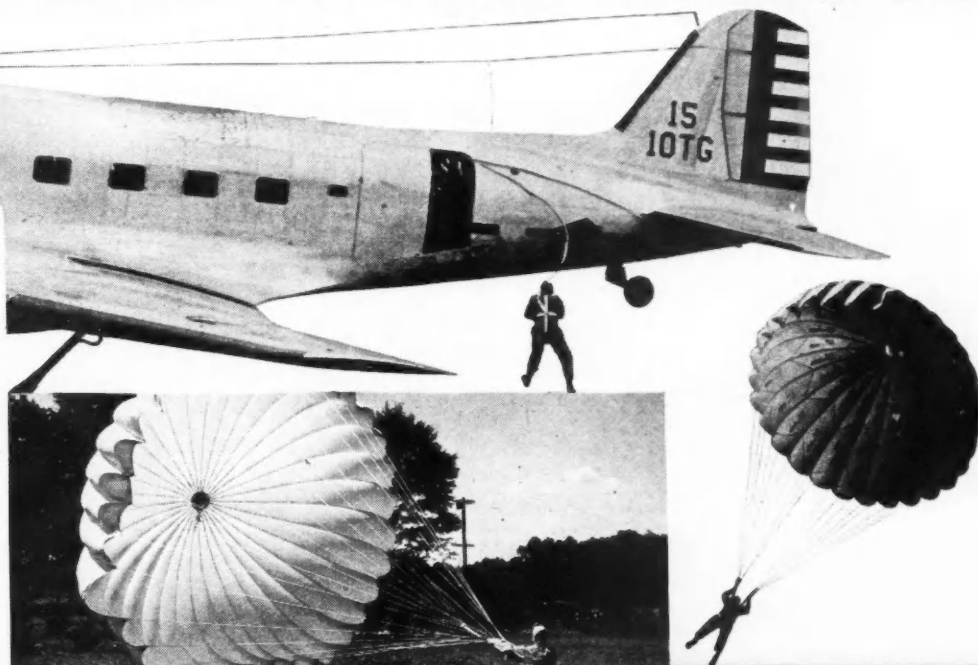


RUBBER in air defense

Koyalon takes bumps out of jumps

at low altitudes by parachute troops whose boots are provided with shock-absorbent pads of a new type of foam cushioning material that is whipped up from the pure milk of rubber trees! Non-skid rubber soles also help parachutists grip the ground, while elastic shroud lines make management of the chute easier in the air and during landings.

PHOTOS BY U. S. ARMY SIGNAL CORPS



U. S. ROYAL De Luxe for highway defense

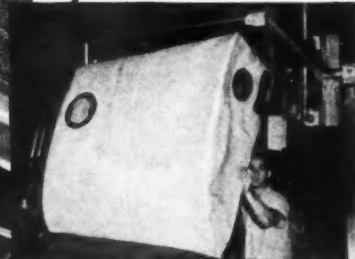
Expertly engineered in body construction and tread design to protect against high speed blow-outs and dangerous skids, the Royal De Luxe stands day and night guard over millions of motorists on every highway in America.



Hung from roof like bat in cave, is this big Army bomber equipped with U. S. Rubber self-sealing gasoline tanks.

PHOTO BY DOUGLAS AIRCRAFT CO., FROM NATIONAL DEFENSE ADVISORY COMMISSION

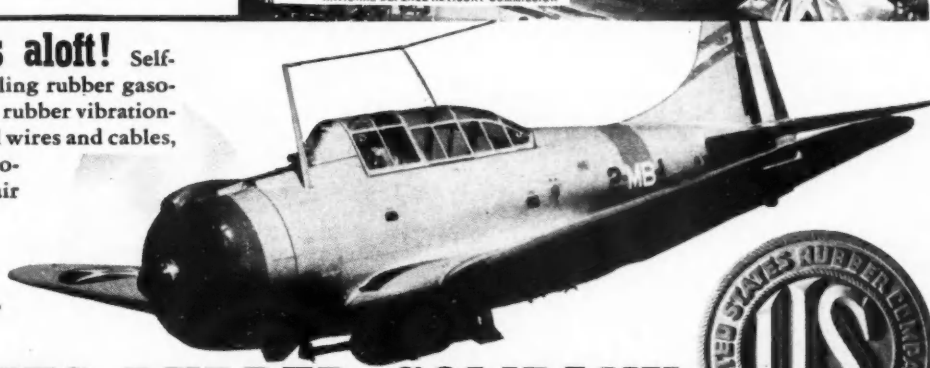
Inserting self-sealing rubber gas tank in wing of Douglas bomber. Example of "U.S." engineering genius, this tank's instant-sealing construction permits penetration by bullets without loss of gasoline or vapor—thus cutting fire hazard. A 20% lighter rubber-and-metal armor for planes is also being developed by "U.S."



DOUGLAS AIRCRAFT CO. PHOTO

Rubber keeps air fleets aloft! Self-sealing rubber gasoline tanks, self-sealing rubber gasoline and oil hose, molded rubber parts, rubber vibration-absorbing mountings, rubber insulated wires and cables, rubber refueling hose, rubber stratosphere suits keep our army and navy air fleets ready for "all out" defense.

OFFICIAL U. S. NAVY PHOTO



UNITED STATES RUBBER COMPANY

6600 E. Jefferson Ave., Detroit, Mich.



Record Exports of Motorboats and Engines

Exports of motor boats, outboard and inboard marine engines, both oil-burning and gasoline, set an all-time record for the first three months of 1941, with total shipments valued at \$6,009,366. Units exported totaled 2043.

During the first quarter of 1940, exports of American-made motor boats and marine engines reached only 1536 units, valued at \$988,196. Due to heavy shipments of high-speed engines and boats to England and Canada late last

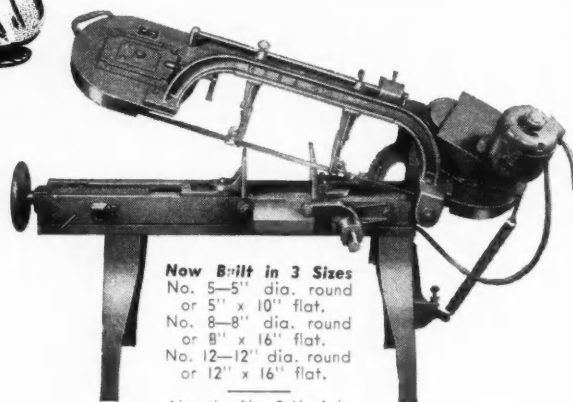
year, the value of the 1940 exports set a new 12-month record at \$9,495,046. Units totaled 8807 for the year.

England and Canada continued as the chief foreign markets during the first three months of 1941, importing more than 60 per cent of the units having a value slightly in excess of \$5 millions.

The Department of Commerce has announced that detailed statistical releases concerning the country of destination of American exports will be eliminated in the future in the "interest of national and hemisphere defense."

Wells SAWS
THE SIGN OF SERVICE

TAKE THE
MOUNTAIN
TO MAHOMET



Now 8" tilt in 3 Sizes
No. 5—5" dia. round
or 5" x 10" flat.
No. 8—8" dia. round
or 8" x 16" flat.
No. 12—12" dia. round
or 12" x 16" flat.

Also the No. 9 Upright
Saws

ARE you wasting time taking metal to the saw for cutting? A portable Wells saw can be quickly shifted to handle metal cutting jobs anywhere in the plant. Valuable minutes used in carrying material back and forth are saved for greater production. Sheets, tubes, bars and angles are cut rapidly, accurately and economically. The Wells is just the saw for the countless odd cutting jobs that pop up around your plant. Investigate today—sold through leading mill supply houses or write direct.

WELLS MFG. CORP., Three Rivers, Michigan

PUBLICATIONS

Witteck Mfg. Co.'s latest bulletin WF-339 contains complete information on **automatic roll feeds** that provide an improved method of punch press operation.*

A new bulletin by Landis Machine Co. covers its entire line of **threading machines, collapsible taps and die heads**.*

Boyer-Campbell's new circular "Protection for the Eyes and Face" features 20 different models of **face shields**, all interchangeable in parts with the exception of two. One shield with different windows covers most operations.

A new 20-page booklet by Oakite Products, Inc., reviews 53 different formulas for machining ferrous and non-ferrous metals with specially designed Oakite **cutting lubricants and grinding coolants**. Other data on several related subjects, drawing and stamping compounds, rust-proofing iron and steel parts between manufacturing operations, etc., are also included in the booklet.*

The May-June issue of Oakite News Service includes an article on proper metal surface preparation for **spot welding**.*

"Vibration Control" (Bulletin No. 104) issued by the Lord Mfg. Co. contains engineering information on vibration isolation. The booklet is in color and has several interesting charts on the relation of static deflection, natural frequency and vibration isolation efficiency.*

Belle City Malleable Iron Co. and Racine Steel Castings Co.'s folder "It Takes All Kinds of Ferrous Castings To Build Track Type Tractors" is intended to give the designing engineer and production man a broad view of the possibilities of the unusually wide range of ferrous castings made by this company.*

The June issue of Wil-Rich Forum, published by Wilcox-Rich Division of Eaton Mfg. Co., contains an article discussing problems in **valve gear and designs to overcome them**. The company also has a new booklet "The Sodium Cooled Valve".*

New literature by Westinghouse Electric & Mfg. Co. includes a 4-page folder describing **welding control panels**, and a booklet on coupled **reduction gears** for driving compressors, line shafts, etc.*

American Wheelabrator Digest, published by The American Foundry Equipment Co. has several interesting articles devoted to better metal cleaning practices. The booklet is well illustrated.*

Worthington Pump & Machinery Corp. has issued a new circular on its **horizontal duplex plunger power pumps**. It has illustrations of installations, specifications of the different types, etc.*

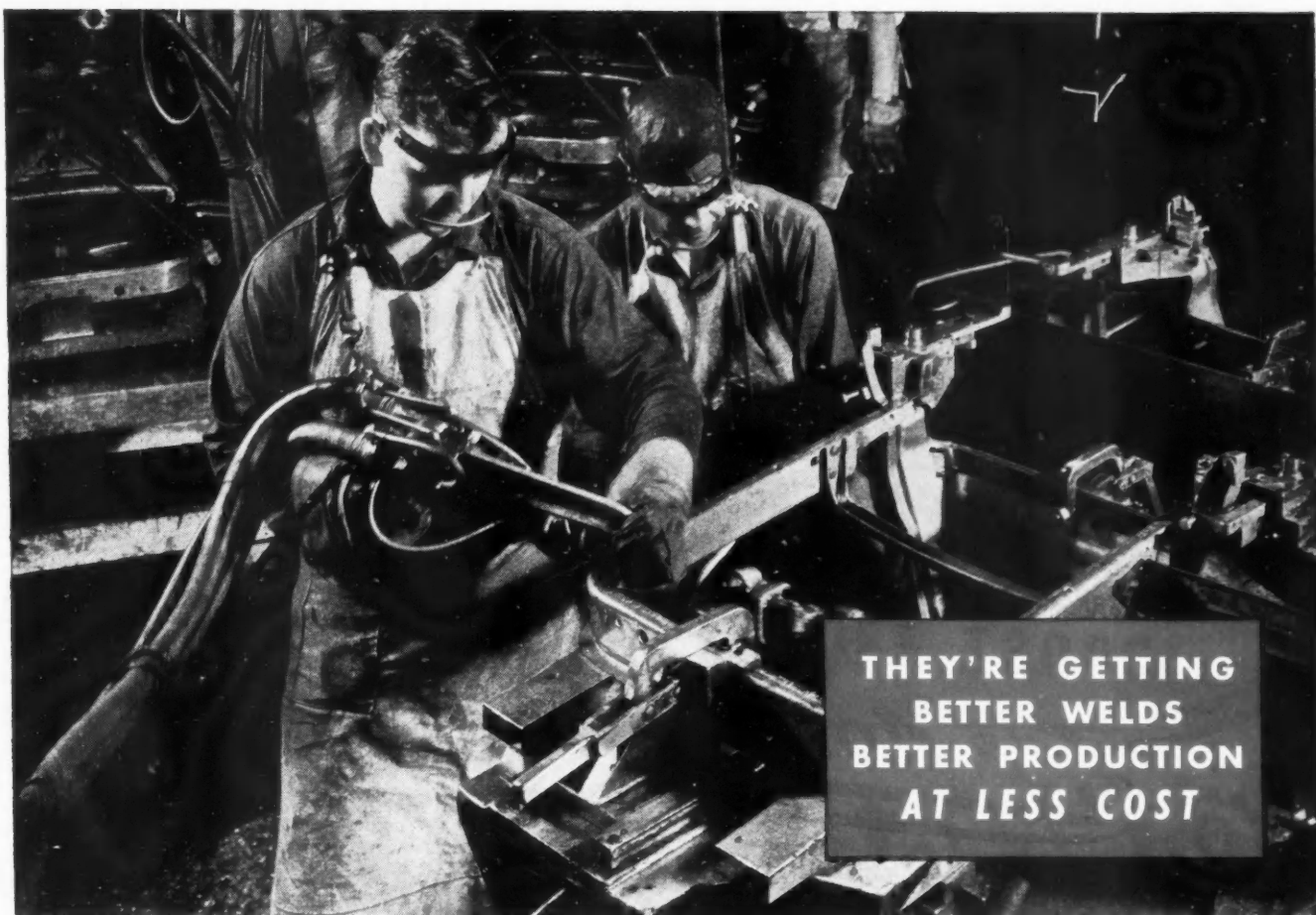
The Carlyle Johnson Machine Co. has a new bulletin covering their "Maxitorq" **floating plate multiple disc clutch**, which features single as well as double types of clutches in sizes No. 22, No. 23, No. 24 and No. 25, with capacities of 1/2 to 3 hp. at 100 r.p.m.*

The May issue of *Grits and Grinds*, Norton Co. publication, contains an interesting article on cutter grinding set-ups.*

Western Electric Co.'s attractively illustrated booklet Teletalk describes its various models for amplified intercommunications systems. Detailed specifications are listed for all models.*

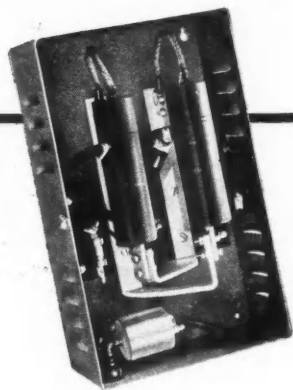
A second edition of the P. R. Mallory **resistance welding data book**, just off the press, is divided into four major sections—fundamentals of resistance welding; materials to be welded; alloys for resistance welding applications; and miscellaneous tables. A comprehensive index has been included to facilitate quick reference. Supplementing the handbook is a booklet on the subject of Mallory resistance welding electrodes and alloys.

*Obtainable through editorial department. **AUTOMOTIVE INDUSTRIES**, Address Chestnut and 56th Sts., Philadelphia. Please give date of issue in which literature was listed.



**THEY'RE GETTING
BETTER WELDS
BETTER PRODUCTION
AT LESS COST**

NEW WELD-O-TROL EQUIPMENT PAYING DIVIDENDS IN ALL AROUND SAVINGS



HERE'S WHAT YOU GET WITH WELD-O-TROL

REDUCED OUTAGE CHARGES—current turned "on" and "off" 600 or more times per minute.

BETTER WELDS—no mechanical delay—no stopping and starting.

REDUCED MAINTENANCE—no moving parts to wear out.

Burned resistance welds and poor bond between metal were constant sources of trouble on body assemblies at this well-known automotive plant. Shutdowns were frequent and maintenance was heavy due to the type of welding control in use.

But today the picture is entirely changed. Seventeen gun-welders, each equipped with Weld-O-Trol, have completely eliminated burned welds. A stronger bond is now obtained with half as many welds as used formerly. Rejected assemblies

have reached a new low. And during the six months the Weld-O-Trols have been on the job, they haven't cost a penny for maintenance.

Weld-O-Trol's complete **ABSENCE OF MOVING PARTS** is the feature largely responsible for this remarkable improvement. It does away entirely with time delay—giving you the full accuracy of the welding timer and a closer control of current.

If you'd like to know more about Weld-O-Trol, drop us a line. Ask for Bulletin F-8451-A.

WESTINGHOUSE ELECTRIC & MFG. CO., EAST PITTSBURGH, PA.

J-21064

Westinghouse Weld-O-Trol



Ford Contract

(Continued from page 50)

President Edsel Ford expressed the company viewpoint in a statement after the signing, when he said, "As the company now views the situation, no half-way measures will be effective. We cannot work out one scheme of things for some of our workmen and another scheme for the remainder. So we have decided to go the whole way. . . . We hope very sincerely that it (the contract) attains the ends sought and results in peaceable and uninterrupted

production, that the company's operations toward national defense shall not be hampered in any way."

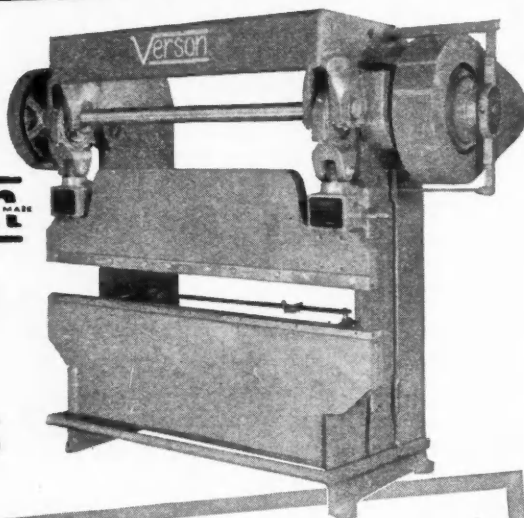
Commenting upon the contract, Philip Murray said, "The pattern set by Mr. Ford in this contract might very well be followed by other leading industrialists in the U. S."

Irvan Carey, president of the UAW-AFL, which claims a majority in several Ford assembly plants, said "Mr. Ford has no right to enter into an agreement with the CIO to throw out pending NLRB cases filed under the name of the UAW-AFL."

Available **TO HELP**
BOOST PRODUCTION
Now!

Verson

**JUNIOR
PRESS
BRAKES**



IT isn't necessary to allow production to become congested because of the long wait for delivery of big machines when Verson Junior Press Brakes are available. Put them to work now and relieve pressure all along the line.

Don't let your heavy machines get tied up on the lighter work that can be handled easily by these capable low cost units. Short heavy jobs and longer light jobs of forming, bending, coping, notching and multiple punching are done quickly and accurately on the Verson Junior. You'll be pleased, too, by the many important features ordinarily found only in larger and costlier press brakes.

There are seven sizes from which to choose the proper machine for your requirements. Write today for complete details—ask for Bulletin JPB 40.

VERSON ALLSTEEL PRESS CO.
9307 SOUTH KENWOOD AVE. • CHICAGO, ILLINOIS

CENSORED

An exclusive feature prepared by the London correspondent of AUTOMOTIVE INDUSTRIES, M. W. Bourdon.

The British automobile industry has lost a prominent figure in the death of Laurence H. Pomeroy, who was managing director of the Daimler Motor Co. from 1929 until 1936 when he joined the De Havilland Aircraft Co. From 1919 to 1926 he was in America engaged in development work with the Aluminum Co. of America.

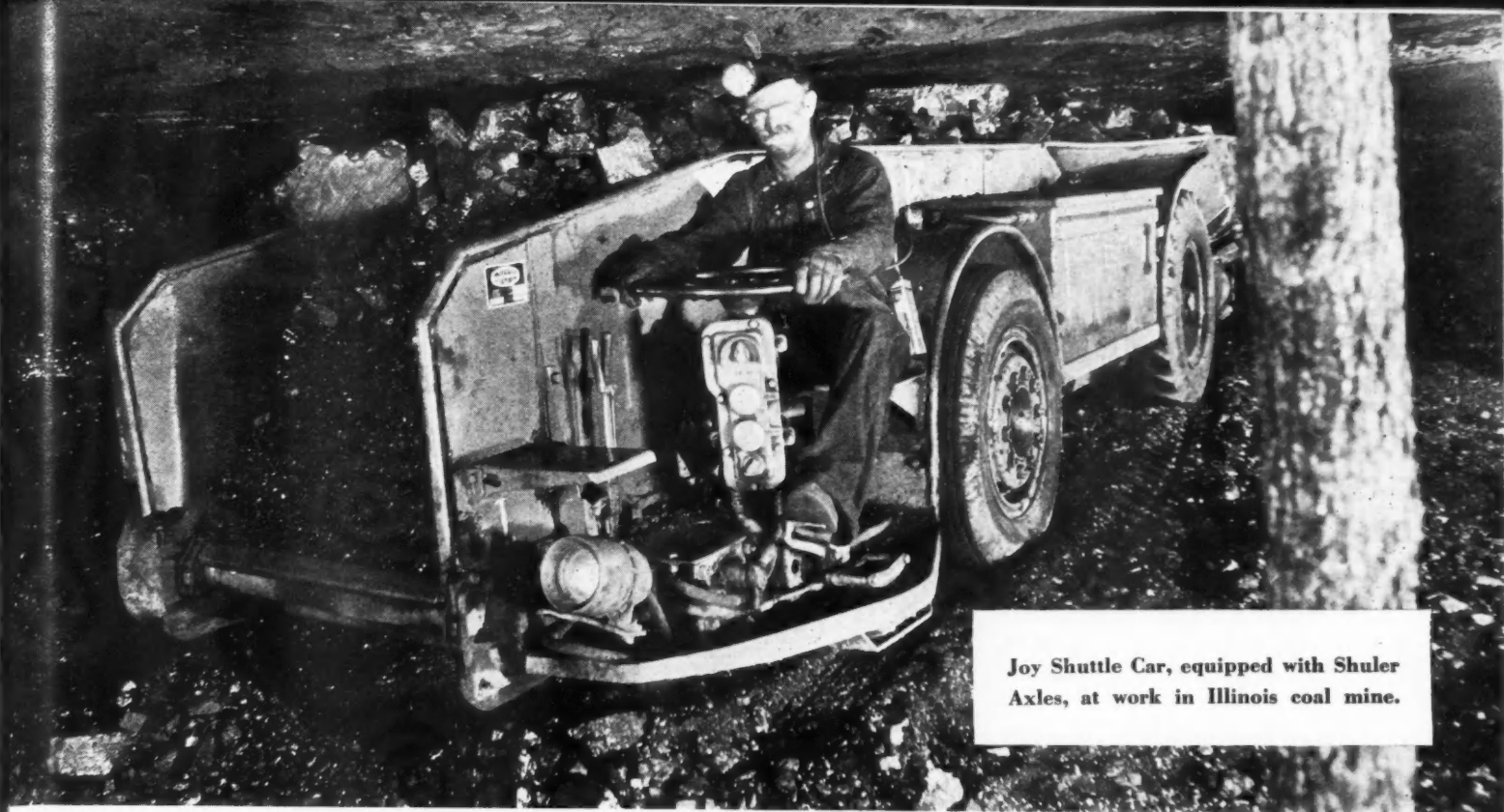
By arrangement with the Ministry of Supply, Morris trucks until the end of the war will be produced for civilian service in one model only. The model chosen has a load capacity of 3½ long tons, a four-cylinder engine rated at 56 hp. and a 142-in. wheelbase. Only two body styles will be available, an open truck and a similar body with a detachable canvas top.

Waste of liquid fuel or "failure to use it in a manner that will effect all reasonable economy in its consumption" has been made an offense under the Defense Regulations. Another step to save gasoline and oil fuel is the order to keep out of use on one day each week all Army vehicles operating in Britain except those necessary to maintain essential services. These "transport holidays" are devoted to overhauling and repairing the vehicles.

In some parts of Britain bus operators, both municipal and private, converted their fleets from gasoline to oil fuel are now confronted with a situation in which gasoline is more plentiful than oil fuel, but cannot adapt their engines for use of the latter. In Scotland the curtailment of services on this account applies to all areas and affects more than 2000 oil-engined buses.

American tipper trucks for civilian use on urgent Government work are being imported. The first arrivals are K7 International 4-5 tonners and have been put into immediate operation on debris-clearance in London.

The London Passenger Transport Board has produced a new type of Diesel-electric railroad locomotive. It can be run on either the rail circuit or as a self-contained unit operated by current from its Diesel-electric generator. Ordinarily, hauling up to 600 long tons, it is used mainly for freight, but is available in an emergency, as after an air raid causing damage to the power supply, for passenger services in the London "Underground."



Joy Shuttle Car, equipped with Shuler Axles, at work in Illinois coal mine.

YOU SAID IT—SHULER AXLES CAN REALLY TAKE IT!

No matter where they're used—on coal mining trucks, on transport trailers, on road-building tractors—Shuler Axles can, and *do*, take plenty of punishment!

Yet *toughness* is only part of the reason why Shuler Axles are used on most of America's *heaviest-duty* automotive equipment. Another excellent reason is that Shulers are literally *easier to steer*. And there are lots of applications where this one factor alone is enough to make them *essential*.

Is it any wonder that more and more users are turning to Shuler Axles? If you want the strength and dependability of Shuler construction — *at no extra cost!* — write for specifications and quotations.

SHULER AXLE CO., Incorporated, LOUISVILLE, KY.

Export Division: 38 Pearl St., New York, N. Y.

West Coast Warehouse: Ford & Derby Sts.,
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BETTER SERVICE!

Many of Shuler's best customers were first won by our eagerness to be helpful in emergencies—such as in rapidly getting out troublesome "specials" and small orders. We invite you to test our cooperativeness on any of our products:

Shuler Square and Tubular Trailer Axles

Shuler I-Beam Trailer Axles for Utility or House Trailers

Shuler Front Axles for Trucks, Tractors, Farm Machinery, etc.

Shuler Truck and Trailer Brakes

Shuler Heavy-Duty Brakes and Trunnion Axles for Low-Platform Heavy-Duty Trailers

Custom Forgings

SHULER

AXLES AND BRAKES

Steel Supply

(Continued from Page 44)

supplies subnormal at this time. The not inconsiderable tonnage contained in used cars that ordinarily would have been scrapped, for instance, is held up because many of these cars now are being reconditioned and offered for sale. Here is one problem for which there seems to be no easy solution through official regulation.

In the light of recent developments, steel market opinion inclines to the belief that any future curtailment in

automobile production will not be so much a matter of arbitrarily scaling down limitation on the basis of 1941 car output, as of adjustment to whatever tonnage of steel and other essential metals will be available. Taking time by the forelock, a number of steel companies with continuous sheet and strip mills, are anticipating the Government's request for increasing steel plate production and the necessary changeovers are already under full headway. Increased production is needed primarily for ship plates and freight car construction.

Although not all of the sheet and strip steel producers have been asked

to divert tonnage to plate production, a general revamping of schedules is necessary, for the OPM is anxious to obtain the required volume of plate without cutting too much into the sheet and strip facilities and at the same time to distribute the burden imposed by the changeovers equally among the large steel producers.

OPM has ordered that hereafter the maximum of primary nickel which may be used in stainless steel shall not exceed 40 per cent of the total nickel content, so that nickel in excess of 40 per cent will have to be supplied by the use of scrap nickel.

The American Iron and Steel Institute's compilation of 1940 steel consumption by various industries, which has just been published, shows automotive consumption still leading all others. Of the 45,851,000 tons of steel distributed last year, 7,195,339 tons or 15.7 per cent went to automotive consumers. Construction industries were second in the classification, accounting for 10.8 per cent. Exports of steel rose last year to 17.7 per cent of total domestic production.

Delay in allocating copper to consumers is said to have been largely caused by difficulties in determining whether such metal shall be billed at 12 of 12½ cents. The former price is that at which primary producers supply copper while the higher level is that quoted by custom smelters, both groups having contributed to the emergency pool, from which allocations are made. The setting up of a similar pool for zinc and regulations to conserve supplies of that metal added further to the difficulties of consumers. Moreover, labor troubles in the Connecticut brass district increased their uneasiness.

OPM Recommends Huge Magnesium Increase

The OPM has recommended the expansion of facilities to produce magnesium metal to a capacity of 400,000-600 lb. annually to meet tremendously increased requirements for aircraft and other military uses. Present production is at the rate of approximately 30,000,000 lb. and additions to plants already under way will raise that capacity to approximately 75,000,000 lb.

It is expected that negotiations for the erection of new facilities will be carried on by the War Department, the Defense Plant Corp., and seven or more companies producing or interested in the production of magnesium metal. The Dow Chemical Co. which has plants at Midland, Mich., and Freeport, Texas, and the Permanente Corp., which is constructing a plant at Palo Alto, Calif., are at present the only producers of this metal.

Verne H. Wilcox

Verne H. Wilcox, affiliated with the Hupp Motor Car Corp. for 23 years, died June 21 at his home in Detroit.



WHEN a prominent automotive manufacturer undertook to produce fuse detonator caps rigid inspection requirements against scratches and discoloration brought a hurry call for a Kerns service man to develop a suitable drawing compound. Careful chemical development brought these immediate results.

- 1—LESS BREAKAGE**
- 2—SCRATCHES ELIMINATED**
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- 6—DIE LIFE INCREASED**

We are anxious to demonstrate a KERN'S Drawing Compound on Your Toughest Job. Write or phone for test samples. No obligation.

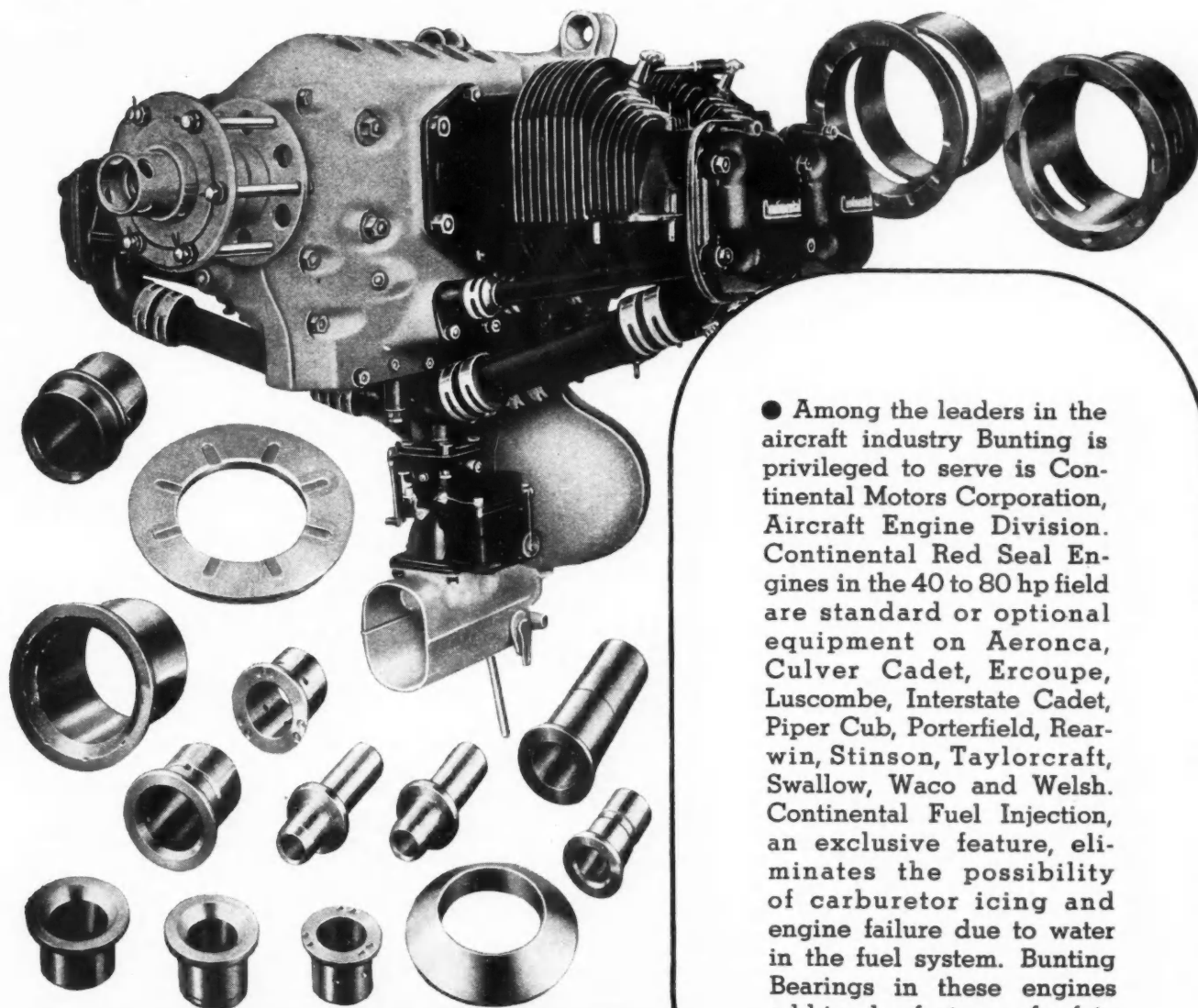
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AVIATION LOOKS TO *Bunting FOR Bronze Bearings*

● Because Bunting experience, special knowledge and production facilities fully meet the severest and most exacting requirements in mechanical industry, this company today is supplying precision bronze bearings to

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● Among the leaders in the aircraft industry Bunting is privileged to serve is Continental Motors Corporation, Aircraft Engine Division. Continental Red Seal Engines in the 40 to 80 hp field are standard or optional equipment on Aeronca, Culver Cadet, Ercoupe, Luscombe, Interstate Cadet, Piper Cub, Porterfield, Rearwin, Stinson, Taylorcraft, Swallow, Waco and Welsh. Continental Fuel Injection, an exclusive feature, eliminates the possibility of carburetor icing and engine failure due to water in the fuel system. Bunting Bearings in these engines add to plus features of safety and dependability.



ASTM Meeting

(Continued from page 42)

chrometers of electronic type for taking measurements without pressure, offered a new shop instrument capable of routine production measurements within an accuracy of .000025 in.

Among other exhibitors were Leeds & Northrup, Illinois Testing Laboratories, C. J. Tagliabue Mfg. Co., Riehle Testing Machines, ASTM committees. Significant to production men and metallurgists of the automotive industry was an educational display by the

Welding Research Committee of the Engineering Foundation, including data on different types of spot weld test specimens, examples of dynamic pressure records, and publications. The project is being carried on in the laboratories of the Rensselaer Polytechnic Institute, University of Illinois, and the Illinois Institute of Technology.

Art in the seemingly prosaic field of metallography and scientific instrumentation reached a well-deserved peak in the photographic exhibit. The New Jersey Zinc Co., seemed to have the lion's share of the artistic honors with a first award in the professional class,

a second prize for a metallographic study of cast zinc with lead, and a number of other entries.

First formal session featured an address by the president of ASTM, Dr. W. M. Barr, Union Pacific R.R. Co., on the subject, "Speed, Specifications, Safety" chiefly concerned with materials for rail transportation equipment. J. H. Van Deventer, president of IRON AGE, talked on "Mobilizing Materials for Defense" at the same session. In all, the meeting contained something over 115 technical papers and committee reports touching on every phase of industrial activity.

Aircraft Parts

(Continued from page 40)

is manufacturing barrage balloon equipment, including winches, for the Army. American Bantam Car Co., Butler, Pa., has received an RFC loan for \$1,094,870 for equipment used in the manufacture of ¼-ton combat cars and an additional order for \$864,141 for 1000 "blitz buggies" has been received in addition to the initial order for 1070 which has been filled. International Harvester Co. has received an order for 1200 trucks for the Marine Corps.

Continental Motors Corp., is working its Detroit plant, which employs 1200 men, on a 7-day, two-shift basis in turning out 200-hp. tank engines for light tanks. The company, which also is making automotive and aircraft engines for the government at both its Detroit and Muskegon plants, has more than \$72,000,000 in defense orders.

Other recent national defense orders include \$10,293,675 to Firestone Steel Products Co. for metal links for tanks; \$150,279 to Champion Spark Plug Co. for spark plugs; \$127,400 to Wisconsin Axle Division of Timken-Detroit Axle Co. for tank transmissions; \$708,677 to Mack Mfg. Corp., New Brunswick, N. J., for tank parts for transmission and final drive units; \$211,155 to Cummins Engine Co., Washington, for generator sets; \$393,800 to Delco-Remy Division of GM, Anderson, Ind., for assemblies; \$288,492 to Budd Mfg. Co., for bombs; \$436,840 to F. L. Jacobs Co., Detroit, for fuse parts; \$3,582,197 for spare parts for scout cars; \$1,799,070 to Autocar Co. for spare parts; \$150,062 to Fruehauf Trailer Co. for semi-trailers.

Large scale production of aluminum forgings for military aircraft construction will be undertaken by Willys-Overland Motors, Inc., next fall. A loan of \$2,172,000 from Defense Plant Corp., is being used to convert part of the Willys-Overland forge shop to aluminum work with a capacity estimated at 40,000 lb. of forgings daily.

Among important defense plant expansions reported by Electric Auto-Lite Co. is a \$600,000 addition to the Corcoran-Brown Lamp Division in Cincinnati for black-out lighting, a new \$300,000 battery plant at Atlanta, and a 50 per cent expansion of its plant at Sarnia, Ont.

Investigate the Advantages



of Acadia Molded Synthetic Rubber Products

• Engineers throughout the automotive industries are finding new and better solutions to many production problems with molded synthetic rubber products.

There are many variations of Acadia Synthetic Rubber Products. They are produced from many formulas in molded form and provide important advantages where high heat and oil are encountered.

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Rubber parts offer greater resistance to aging, heat, sunlight, alcohol, oils, kerosene, and other destructive solvents . . . are widely used for washers, gaskets, packings, diaphragms, and other important parts.

Put your problems up to our Engineering Department, submitting blueprints when necessary. You are assured of prompt and efficient co-operation in meeting your production requirements.

ACADIA SYNTHETIC PRODUCTS DIVISION

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... *with* Precision Machine Tools

SUCCESS of the vast effort to attain national security is based directly on how swiftly manufacturers can produce . . . produce without any sacrifice of those standards of accuracy that have made mass production of interchangeable metal parts a distinct American accomplishment. *Ex-Cell-O's place in the great emergency is obvious.* As one of the nation's leading builders of machine tools, its high-precision products have for years contributed to the increasing of metal working efficiency . . . today, practically every branch of modern industry depends upon them when accuracy, speed, economy are the requirements. The same superior skill and experience that made these Ex-Cell-O achievements possible in the past . . . that have made Ex-Cell-O a common word for precision wherever machine tools are used . . . are willingly pledged to the great task now placed upon them—to serve American industry to the ultimate degree of human power in the supreme job of protecting America.

EX-CELL-O CORPORATION • DETROIT, MICHIGAN



**DEFEND
AMERICAN
FREEDOM**
IT'S EVERYBODY'S JOB

NATIONAL ASSOCIATION OF MANUFACTURERS



Precision THREAD GRINDING, BORING AND LAPPING
MACHINES, TOOL GRINDERS, HYDRAULIC POWER UNITS, GRIND-
ING SPINDLES, BROACHES, CUTTING TOOLS, DRILL JIG BUSHINGS

Aircooled Motors Production Line Displays Adaptability

(Continued from page 27)

down the head and maintain the valve seat inserts in position during the operation of screwing-in of the barrel. The barrel is carefully adjusted in place, screwed home by means of a long lever. Owing to the technique of threading both parts so that the start of the thread is given a definite location, the assembly operation is controlled by a stated number of turns of the lever, is

stopped at a standard mark on the fixture.

After assembly, the head and barrel unit are fluid-tested. As illustrated, the fixture is fitted with a Westinghouse air brake cylinder having a dual function—first it seals the testing fixture, then it is used for applying air pressure to the bore interior while the part is immersed in the tank. Incidentally, the testing tank is filled with a mixture of kerosene and oil, thus avoiding the pos-

sibility of corrosion, also making it unnecessary to degrease or heat after testing.

The two sizes of connecting rods are machined in a compact department, according to the routing reproduced elsewhere. The rod is a one-piece forging sawed apart at the seventh operation on a No. 3 Cincinnati mill. As noted, the big end bore is drilled, then semi-finish-reamed after assembly, then precision bored in an Ex-Cell-O boring machine using Carboly-tipped fly cutters.

Rocker arms are machined on an interesting line which is said to have high productivity and to be quite economical in cost. The hole is precision-bored in an Ex-Cell-O boring machine, utilizing the same machine as is used for connecting rod boring.

Final assembly has many features of interest to builders of small engines. Its backbone is the gravity roller conveyor line arranged with sub-assembly stations at the side. Examination of the photograph of this line will show an outstanding detail, namely, the installation of a stock crib consisting of small parts bins mounted directly above the conveyor within easy reach of the operators.

Engine assembly begins with the crankshaft which is fitted vertically in the fixture. The crankcase comes next. Before assembly it is thoroughly cleaned in a steam washer built directly into the line. As mentioned above, various sub-assembly stations are located on one side of the line with suitable benches and special testing equipment. One of these stations, for example, takes care of the piston and rod assembly. This bench is provided with a small oven for heating the piston for the shrink-fit assembly of the wrist pin. Heating is done with an infrared baking lamp instead of the fuel-fired baking oven usually employed.

Another station handles the assembly of the oil pump. The bench has a special testing machine for testing pump pressure as well as the general functioning of the pump before it is installed on the engine.

The rocker arm mechanism is assembled on another bench, this one being equipped with an infra-red heating chamber to facilitate the shrink-fit assembly of rocker arm support pins in the block.

As the assembly proceeds down the line, in its final stages the engine is transferred to another fixture which carries it on its side to facilitate the installation of accessories and attachments—magnetos, ignition wiring, spark plugs, etc. At the end of the line, the engine is subjected to an oil pressure test of 60 lb. per sq. in. to check the functioning of the lubrication system and to assure oil tightness of all gasketed joints.

Completed engines then are lifted off the line by means of a Curtis air hoist, transferred to the overhead trolley line which transports them to the test house. Upon completion of the standard test schedule in the test cells, the engines are cleaned in a steam chamber, then

MORE and more tool rooms and die shops are taking advantage of Duro Hand Grinders to speed up production. These grinders have surplus power, the Heavy Duty Grinder a 40 watt output, the Streamline Grinder a 17 watt output. Both Grinders turn 24000 R.P.M., enabling work to be turned out faster, better and cleaner. They are designed and built to give long trouble-free performance. They have power—speed—precision—compactness—balance and streamline design—everything needed to improve tool maker's work and save much valuable time. You can get immediate delivery in any quantity. Send for literature today.

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DURO

Hand GRINDERS

UNEXCELLED
for
GRINDING
CUTTING
SANDING
POLISHING
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DRILLING



**DURO
Heavy
Duty
GRINDER**



**DURO
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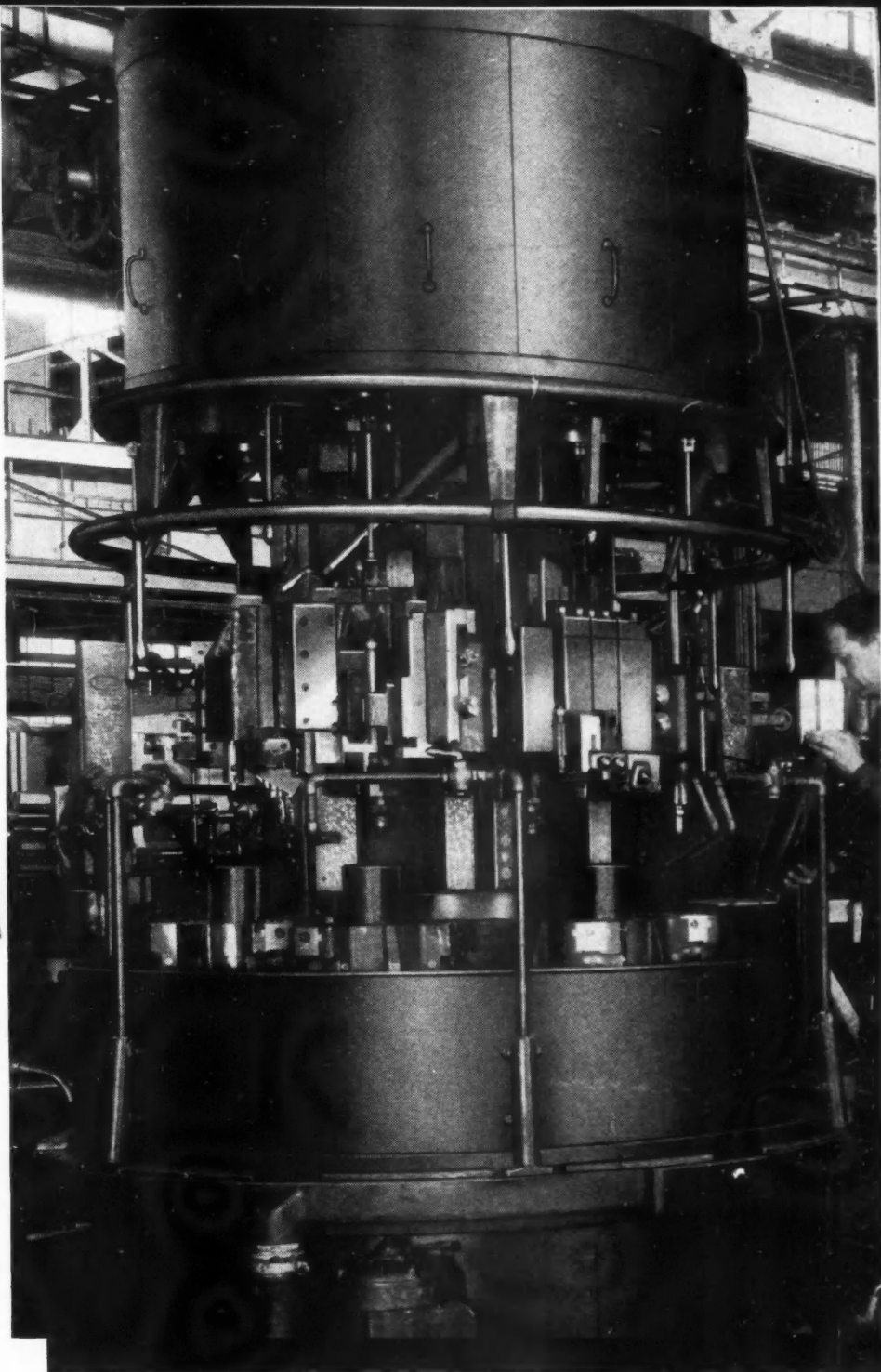
**DURO Heavy Duty
GRINDER KIT**

**DURO
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**MULT-AU-MATICS
ARE THE CHOICE
for
SHELL BODIES
from
37 MM to 155MM**

MANUFACTURERS who are or expect to be engaged in shell manufacture, and who are not now using Mult-Au-Matics are invited to write us for answers to these questions:

1. What is production time by the Mult-Au-Matic Method on my size shells?
2. What delivery dates can I expect if I order Mult-Au-Matics for a shell contract?



THE BULLARD COMPANY
BRIDGEPORT, CONNECTICUT

transported to the baking oven for drying, then routed to the paint spray booth, and finally returned to the baking oven.

The oven used for the above operations is essentially a small tunnel oven made up of a bank of infra-red baking lamps which are very effective for this kind of work.

Another feature of the assembly department that is well worth noting is the compact overhead trolley system for handling finished engines, for drying, for inspection, and for routing to the shipping dock. This is shown in the pictorial section.

Attention should be drawn to the simple, inexpensive, but extremely effective installation for circulating, filtering, and storing of the engine lubricant used in the test cells during the test schedule. The important element of this system is the equipment for filtering. It consists, essentially, of a large Cuno filter of the familiar adjustable type in series with a commercial filtering unit having a replaceable fabric element. This combination is said to do an excellent job of cleaning the circulated oil, maintaining it in perfect condition for the exacting engine test schedule.

Borg & Beck Coupling

(Continued from page 34)

and may actually result in a roughness equivalent to clutch chatter.

Although the design of the new fluid coupling is quite similar to the 13-in. unit, mentioned earlier, the method of manufacture is entirely new and unique in many respects. This applies particularly to the mounting of vanes in the impeller and runner. Slots are punched at the inner and outer periphery of the torus ring stampings, the slots being held fairly close to size. A multiple die is used for punching eight slots at a time on the impeller, requiring three indexes to produce the twenty-four slots. In similar fashion, the 27 slots in the runner are made nine at a time with another precision die.

The individual blades have a coined area at the tongues which engage the slots. The coining operation controls the thickness of the blade within close limits, produces a taper or ramp which leads the blade into the slots during assembly. Blades are riveted in place by a single rivet engaging the ear at the center of the blade. The impeller assembly is spot-welded to the front stamping at twelve points.

At final assembly, the rear stamping of the coupling housing is shrunk over the front stamping by heating to 500 deg. Fahr. before passing on. The joint then is seam-welded in an automatic arc welder.

Apart from the care taken to assure the accuracy of individual stampings, uniform operation of the couplings is assured by accurate balancing of individual parts, by balancing of the complete assembly. For example, prior to assembly, the runner and hub assembly are balanced to close limits. After the assembly has been completed, final check balance is achieved by welding small metal discs to the fan blades, using a special gun welder.

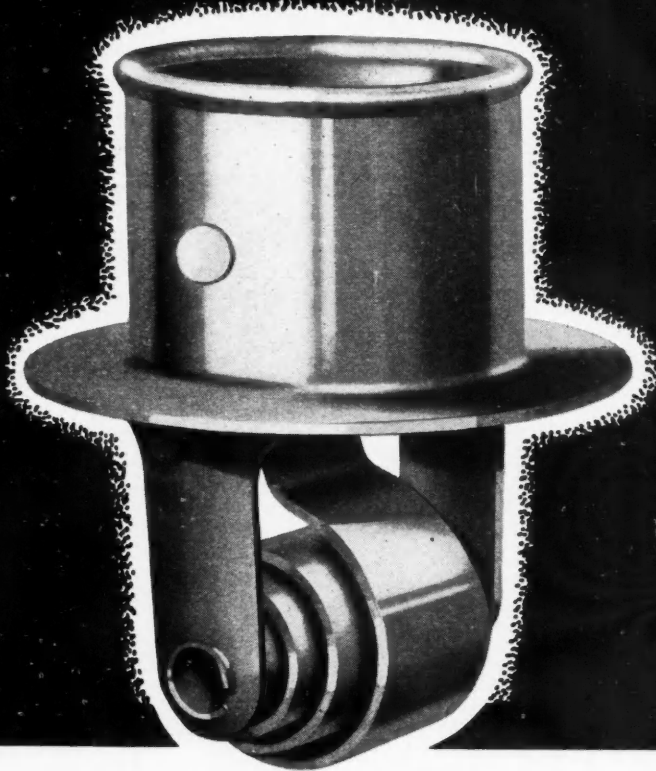
The coupling flywheel, shown dotted on the assembly drawing, is supplied by the individual customer, must be balanced to close limits.

A full description of the manufacture of the coupling will be published in *AUTOMOTIVE INDUSTRIES* in a forthcoming issue.

Prince Heads AIEA

David C. Prince, manager, Commercial Engineering Dept., General Electric Co., Schenectady, N. Y., has been elected president of the American Institute of Electrical Engineers for the year beginning Aug. 1. Other officers elected are: (vice-presidents) N. S. Hibshman, Bethlehem, Pa.; J. Elmer Houseley, Alcoa, Tenn.; Arthur L. Jones, Denver, Colo.; Walter C. Smith, San Francisco, Cal.; C. A. Price, Hamilton, Ont. (Directors) Lester R. Gamble, Spokane, Wash.; T. G. LeClair, Chicago, Ill.; Fred R. Maxwell, Jr., Pensacola, Fla. (Treasurer) W. I. Slichter, New York, N. Y.

ONE BIG REASON for the Industry's Adoption of m. t. c.



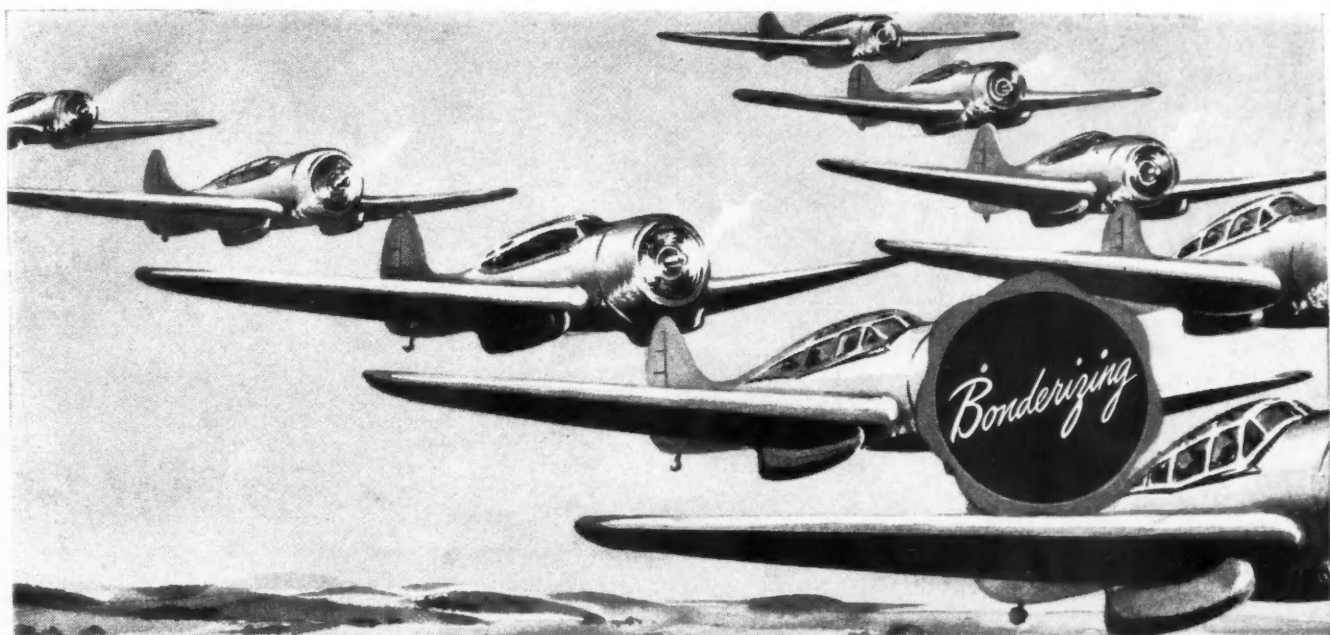
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MEN and MACHINES

(Continued from page 33)

when the Doall is used as a filing machine. (Illustrated on page 33.)

A NEW line of heavy duty hydraulic straightening presses is announced by the Lake Erie Engineering Corporation of Buffalo, N. Y. Special features are C-frame for convenient handling of long bars and fast operation with sensitive control of pressure and stroke. The bed is fitted with V-blocks adjustable to suit work. Spring rollers at

the ends facilitate movement of bars.

Control is by means of a conveniently located hand lever, operation of which determines desired pressure. (Illustrated on page 33.)

WITHOUT creating an obstruction to air flow, hoisting of aircraft engines to position on the propeller test stand at the Wenner-Gren Aeronautical Research Laboratory, University of Kentucky, was solved by installation of

a Manley hydraulic lift, which is made by the Manley Mfg. Division of the American Chain & Cable Co., Bridgeport, Conn. When the lift is in its lower position, only the flanges of the I-beams project slightly above the floor. (Illustrated on page 33.)

WATERBURY FARREL FOUNDRY & MACHINE CO., Waterbury, Conn., has announced improvements covering its complete line of screw thread rolling machines, which are manufactured in four types for rolling screw threads on screws, bolts, rods and other threaded parts. The three inclined types include the automatic lift blades hopper feed, automatic chain hopper feed and the side hand feed machines. The fourth is the horizontal type with hand feed. Each type is built in several sizes.

A COMPACT, single purpose collet chuck, which can be attached quickly to hand-pieces used on Stow flexible shaft machines, has been brought out by Stow Mfg. Co., Inc., Binghamton, N. Y. The new unit is furnished in two sizes, 1/4-in. and 3/8-in. chucking capacities. There are two styles, one with a straight-threaded, hex head stud and the other with a tapered shank.

ONE of the first applications of flexibly mounting a bus engine, which is positioned at right angles to the drive shaft, is illustrated here in a Twin Coach 41-passenger bus. The installation consists of eight Lord bonded

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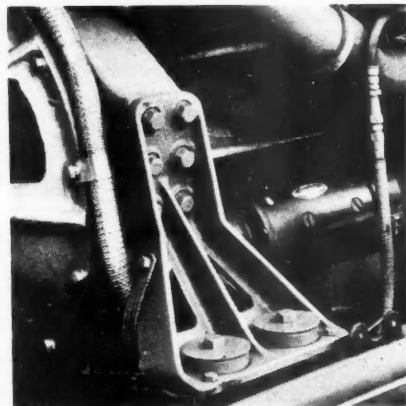
1. To help you avoid production slow-down we are working hard to supply all the springs you need — when you need them.
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Lord bonded rubber mounting for bus engine positioned at right angles to drive shaft

rubber mountings of the shear type designed by the Lord Mfg. Co., Erie, Pa. Each supports a load of 310 lb. They are claimed to effectively isolate engine vibration and also to protect the engine from road shock.

ALL arbor presses now manufactured by Famco Machine Co., Racine, Wis., are equipped with gib adjustments on the face and side so that proper alignment will be maintained at all times. The floor type presses have adjustable tables and the

25% Faster.....



Brazing time is sharply reduced when Airco Hi-Test Flux is put to work because a rod fluxed with Hi-Test can be deposited 25% faster. It eliminates the many interruptions which are necessary when picking up the average dry, powdered flux — interruptions which are largely responsible for harmful, porous braze welds. Due to greatly improved density of deposited metal when using Airco Hi-Test Flux, tensile strength and ductility are increased as much as 20% to 80%. It makes practical the braze welding of red brass and galvanized iron pipe. More good news — Airco Hi-Test Flux is economical to use, and is readily available in any desired quantities.

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bench type units are designed so they can be mounted on a bench or bolted to the ways of a lathe. Famco foot presses also are available with throat depths from 3 to 10 in.

ANGLE PLATE-HOLOATOR is the trade name of the new combination device that has been placed on the market by Dayton Rogers Mfg. Co., Minneapolis, Minn., for use in experimental shops and tool rooms. It is intended for precision drilling, reaming and laying out of dies and drill jigs, and also checking angle plate layouts. Three master bushing disks and four adjustable gaging blocks are supplied with

each Angle Plate-Holocator, which is made in two sizes having a die block and jig plate capacity of 5 $\frac{7}{8}$ in. by 6 $\frac{7}{8}$ in. and 9 $\frac{1}{4}$ in. by 11 $\frac{1}{2}$ in.

Dayton Rogers also has announced improvements in the design of its Model D pneumatic die cushion.

Machine Tool Shipments

Shipments of the machine tool industry for May are estimated at \$60,800,000 as compared to \$60,300,000 for April and \$57,400,000 for March.

Shipments for May a year ago were estimated at \$32,800,000.

What the Industry Is Doing

(Continued from page 36)

Studebaker, Hudson and Nash, had instituted price raises of \$10 to \$53 per car in May or June to offset rising material and labor costs. June consumer sales were expected to be lower than in May because of declining dealer stocks. However, the imminence of a higher Federal excise tax probably effective Aug. 1, as well as low inventories, was expected to spur retail sales in late June and July.

May new passenger car registrations in the U. S. were estimated at 488,000 units by R. L. Polk & Co. on the basis of early reports from 19 states. This is only slightly below the all-time record of 489,074 units set in April. The May total is 24 per cent greater than that for May, 1940. New truck registrations in May were estimated at 69,400 units, 25 per cent above May, 1940. For the first four months of 1941, the new passenger car registrations are 31 per cent greater than the same period of 1940 and 15 per cent above the 1929 period.

Production continued at near capacity levels during late June although a few companies are expected to taper off 1941 model output early in July preparatory to the 1942 model change-over. Most of the large manufacturers, however, have big schedules booked for the month. The week ending June 21 saw output of approximately 132,500 units while the following week was expected to be a few thousand units less. General Motors turned out 55,400 vehicles in June's third week, while Chrysler accounted for 27,200 and Ford, operating on a six-day week, turned out 33,000. Studebaker headed the independents, followed by Nash, Hudson, Packard and Willys.

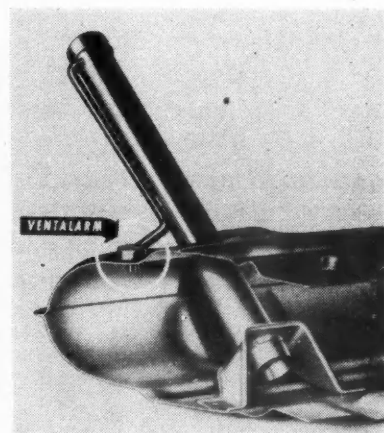
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Ventalarm for Packard

The Scully Ventalarm, which whistles till the tank is all but one gallon full, is standard equipment on the new Packard Clippers. The sub-surface filler also decreases waste from evaporation during the filling cycle

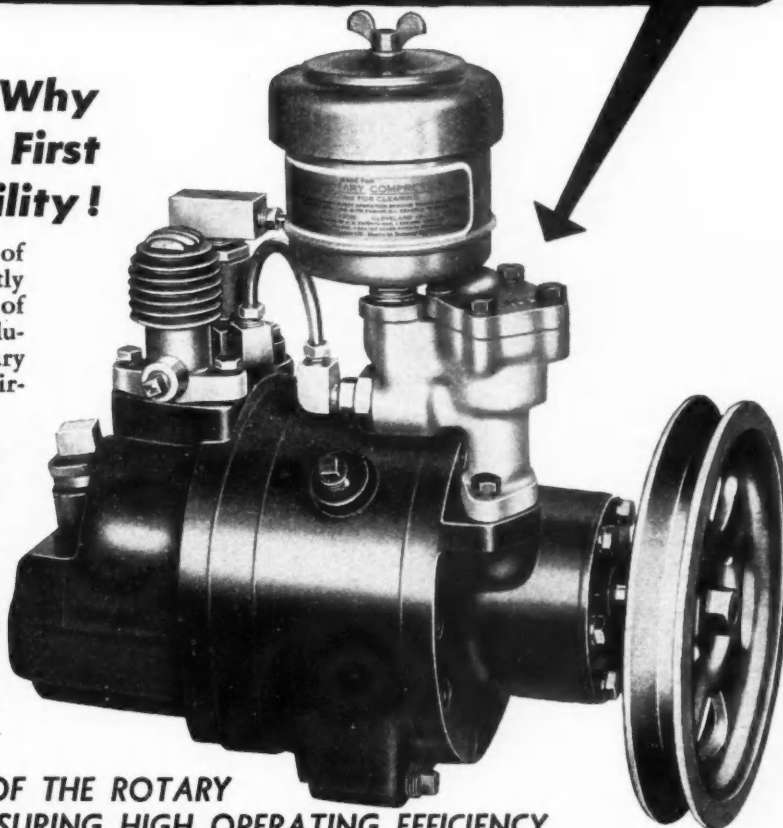
The WAGNER AIR BRAKE

is the **ONLY** Air Brake System
with the Rotary Compressor...

..... That's Why
**Wagner Air Brakes are First
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The Wagner Rotary Air-Compressor is one of the most outstanding developments recently achieved by Wagner engineers in the field of automotive air-brake equipment. This revolutionary type of compressor utilizes the rotary principle to compress the air needed in air-brake systems.

Four overlapping compressions occur during each revolution of the compressor rotor which produce, at running speed, many thousands of air-impulses per minute. This results in a smooth flow of compressed air and the elimination of pulsations in the discharge line, as well as fluctuations in the torque loading. The advantages in this respect are similar to those experienced in the smooth, quiet performance of a modern small-bore six- or eight-cylinder car as compared with a four-cylinder engine.



★ POINTS OF EXCELLENCE OF THE ROTARY COMPRESSOR, ASSURING HIGH OPERATING EFFICIENCY

1. Designed to be driven by a V-belt, in the same way as a generator, and long belt-life is assured because of uniform torque-loading.
2. Speed reductions from the crankshaft are unnecessary since the rotary compressor can be operated at any engine speed normally encountered in motor-truck or bus operation. If it is desirable to run the compressor at speeds greater than engine speed, a smaller diameter compressor pulley can be used.
3. Because rotary, and not reciprocating, motion is used, internal stresses are materially reduced and a compressor of great durability is the result. As a consequence of these low internal stresses, the Wagner Rotary Compressor can be operated, when advisable, at a speed ratio greater than engine speed.
4. Vibration, noise, frictional losses, and wear are reduced to a minimum because of the compressor's design. Relatively few moving parts are employed. Running balance is maintained at all times due to the absence of reciprocating parts.
5. There is very little servicing or maintenance necessary since the rotary compressor has no reciprocating parts such as connecting rods, wrist pins, pistons or piston rings.
6. It has a self-contained pressure-lubricating system, which lubricates, seals, and cools the compressor.
7. Being a self-oiled unit, the oil in the Wagner Rotary Compressor cannot be contaminated by crank-case grit, sludge, or acids which are normally present in engine crank-case oils.
8. The design and operation of the rotary compressor is such that its maximum internal temperature never reaches the point at which carbon is formed. This feature eliminates the necessity of periodically dismantling such parts as the compressor delivery lines, valves, etc., to remove carbon accumulations.
9. The low operating temperature also prolongs the life of the lubricating oil which can be used for thousands of miles without changing.

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Trucks for the U. S. Army

(Continued from page 13)

goes into action, while most of the vehicles are sent to the rear. The armored division, on the other hand, can fight dismounted or mounted, at a halt or in motion.

Motor vehicle requirements of the Quartermaster Corps for 1941 include 65,727 $\frac{1}{2}$ - and $\frac{3}{4}$ -ton trucks and station wagons, 33,213 $1\frac{1}{2}$ -ton trucks, 68,647 $2\frac{1}{2}$ -ton trucks, 5303 4 and 5-ton trucks, and 2574 6-ton and heavier trucks, 5960 ambulances and 6231 passenger cars. In addition, 2018 semi-trailers, 43,860

trailers and 40,379 motorcycles will be required.

The Army has ordered 6570 of the $\frac{1}{4}$ -ton "blitz buggies" from Ford, Bantam and Willys. These little combat cars will climb a 65 to 68-degree grade fully loaded, carry a complement of three men and a mounting for a machine gun. They are designed to replace the motorcycle as an offensive vehicle. The $\frac{1}{2}$ -ton trucks, most of which have been produced by Dodge, include numerous body types, such as

command, reconnaissance, called "jeeps" in soldier parlance, pickups, infantry weapon carriers, cross country ambulances and panel delivery trucks.

The $1\frac{1}{2}$ -ton trucks, supplied chiefly by Chevrolet and Dodge, are employed for cargo purposes and as prime movers of the 75-m.m. field guns. The $2\frac{1}{2}$ -ton six-wheel drive trucks, which Yellow Truck & Coach is supplying in large quantities along with International and Studebaker, are prime movers of 75-m.m. field guns and 105-m.m. howitzers. A winch powered by the motor is attached to the front of the vehicle. This model has two rear-driving axles, mounted in tandem, and a front-driving axle which may be disconnected by the driver.

The 4-ton 6x6 truck, as manufactured by Diamond T, Mack, Autocar, and Federal, is used to haul 155-m.m. howitzers and by the Engineering Corps as a general purpose vehicle. The 6-ton 6x6 moves the 3-inch guns and the 90-m.m. anti-aircraft gun mounts. Other trucks serve special purposes, such as the 4 and 5-ton 4x4 tractor units, which haul semi-trailers, and 5 and 6-ton 4x4 tractor trucks for transporting pontoons and similar bulky loads on semi-trailers. Other special purpose trucks are used by the Signal Corps, Medical Corps, Engineering Corps and commissary.

Ninety-three and $\frac{2}{10}$ per cent of the field artillery in active service is now motorized and mechanized, while in the present German army 75 per cent of the field artillery remains horse-drawn.

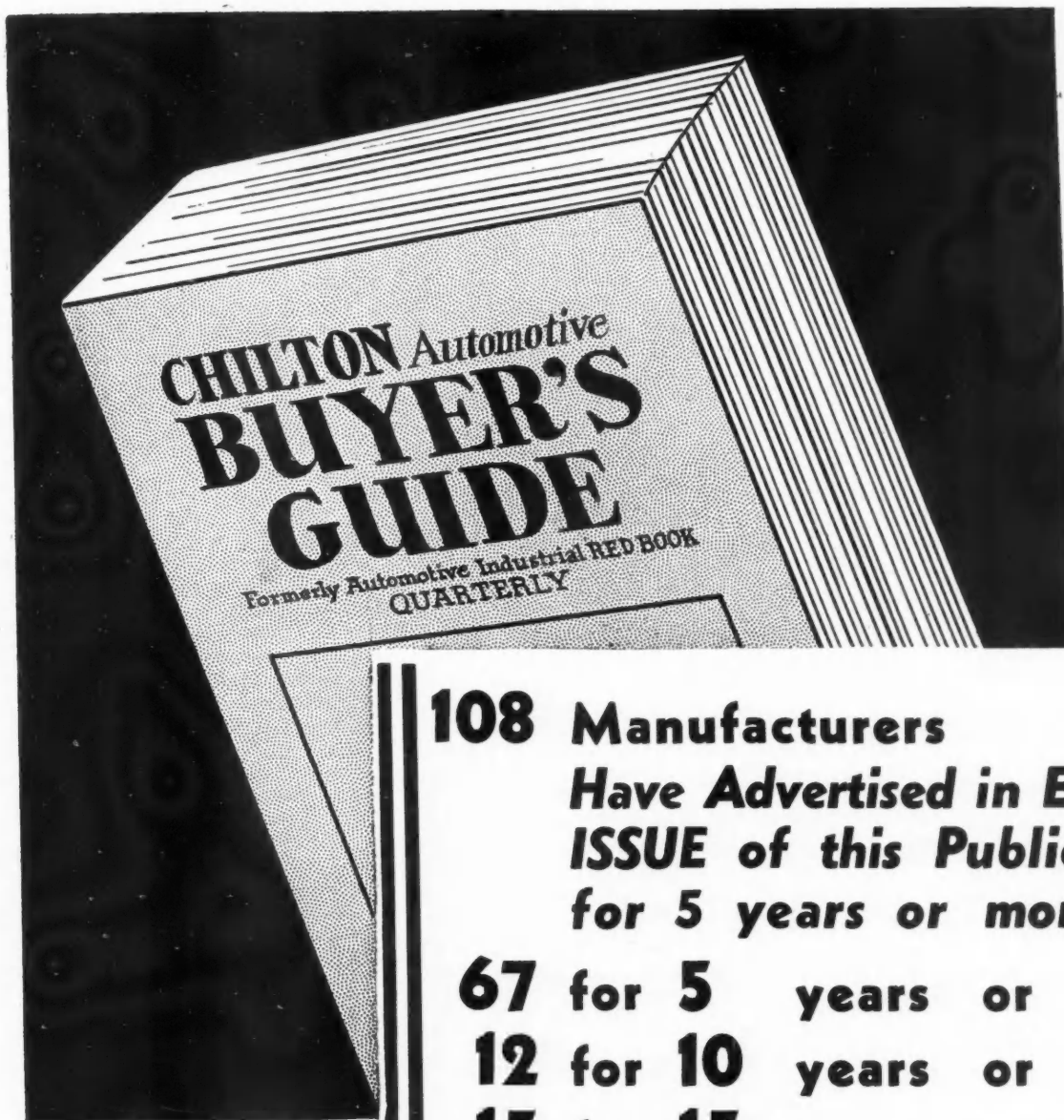
The all-wheel drive principle is now essential on all vehicles used by tactical units of the army. Trucks must be able to go wherever troops and artillery may be located, which may be through woods, across streams, up mountains and down valleys. They should be able to climb a grade of 40 to 50 per cent, travel at least 50 m.p.h., and have a departure of 30 to 45 deg. Other military requirements for these vehicles include adjustable windshields, radiator and headlight brush guards, blackout lighting equipment and towing hooks.

Standardization is another important element of the present army motor procurement program. Chassis types have been restricted to six— $\frac{1}{4}$ -ton, $\frac{1}{2}$ -ton, $1\frac{1}{2}$ -ton, $2\frac{1}{2}$ -ton, 4-ton and 6-ton. The number of makes has been reduced from 216 in the last World War to 16 today. This simplifies greatly the problem of parts replacements, especially in the field. A program of adopting interchangeable parts by the various manufacturers has been carried out with the cooperation of the S.A.E. The number of storage battery types has been reduced from 29 to 2; of spark plugs and generators from 8 to 1; of condensers and speedometers from 6 to 1; of fan belts from 21 to 6, and door handles from 8 to 1. Standardization also has been carried out in fuels, reducing gasoline types from 4 to 3; engine oil types from 8 to 3, transmission

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oil from 4 to 2 and greases from 5 to 3.

Seven motor supply depots are maintained in different parts of the country by the Quartermaster Corps for the procurement, storage and reissue of automotive parts and equipment. These depots are located at Detroit, Baltimore, Atlanta, Omaha, San Antonio, Emeryville, Cal., and Schenectady, N. Y. The Detroit depot, which is the key one in the nation due to its location in the center of the automobile industry requires 350,000 sq. ft. of floor space for parts and equipment and is in the midst of a building program which still will be inadequate when completed. This depot is garrisoned by

46 officers, 330 enlisted men and 500 civilian employees.

Other ramifications of this program include 1,200 service stations being built at 59 cantonments to supply fuel and service for this huge fleet of army trucks. Fort Bragg, N. C., a field artillery center, will require 45 of these stations. About one-third of the present army, 400,000 to 500,000 men, will be engaged in motor transport work in some capacity, such as mechanics, supply men or drivers. A force of 2000 military police will be needed to keep army traffic flowing smoothly.

A division of the armored force, which supplies the hitting power of the

modern army, is composed of 3384 vehicles, including tanks. Two of these divisions already are in service, two more are being formed and four more are contemplated. White Motor Co. Cleveland, already has supplied the armored force with 2,915 4 x 4 scout cars. Another order for 9747 half track scout cars and personnel carriers is being filled by White, Diamond T and Autocar. The personnel carriers, with a caterpillar tread arrangement replacing rear wheels, can carry 10 men up a 60-deg grade and can attain speeds up to 50 m.p.h. over all kinds of terrain. The scout cars carry quarter inch armor plate. On the road a division of the armored force uses approximately 1000 gallons of gasoline per mile.

Army trucks require a considerable amount of strategic and critical materials in manufacture. As an example, an order for 18,990 2½-ton 6 x 6 trucks placed recently with Yellow Truck & Coach Mfg. Co. will require for production 55,000 tons of carbon and alloy steel and gray and malleable iron, 4275 tons of natural rubber, 304 tons of lead, 285 tons of zinc, 665 tons of copper, 190 tons of aluminum, 522 tons of manganese and 78 tons of nickel.

Army motor vehicle orders to date are estimated at approximately \$400,000,000, of which approximately \$180,000,000 will have been spent in the fiscal year ending June 30. Yellow Truck and Coach is first with orders for \$139,796,989 for more than 64,000 trucks, of which 24,276 had been delivered up to June 6. Chrysler Corp. has received orders for more than 73,000 Dodge trucks totaling approximately \$70,000,000, with 46,800 delivered to date. Chevrolet has orders for \$33,000,000 in trucks being produced at 10 assembly plants throughout the country.

White has \$51,000,000 in orders for 8223 armored scout cars, which it is turning out at the rate of 15 per day. Other army truck orders include \$30,000,000 to Autocar for half track scout cars, heavy duty trucks and tractor units; \$28,000,000 to Diamond T for half track scout cars and heavy duty trucks; \$17,000,000 to Mack for heavy duty trucks; \$6,700,000 to International Harvester for various types; \$5,000,000 to Federal for heavy duty trucks; Corbett, \$2,900,000; Ford, \$2,878,000; American Bantam, \$2,579,000; Studebaker, \$15,500,000, and Willys-Overland, \$1,414,000. In addition, Fruehauf Trailer and Nash have received sizable orders for trailers.

Automobiles Outweigh All Other Transportation 4 to 1

The necessity use of automobiles in the United States represents an annual total of 278,800,000,000 passenger miles, according to statistics compiled by the National Automobile Dealers Association. The study further shows that all other forms of transportation combined aggregate but 72,522,000,000 passenger miles.

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